

TECHNOLOGY DEVELOPMENT AND INNOVATION PROGRAM

(CH-0160)

EXECUTIVE SUMMARY

Borrower:	Republic of Chile	
Executing agency:	Ministry of Economy	
Amount and source:	IDB: (OC)	US\$100 million
	Local:	US\$100 million
	Total:	US\$200 million
Financial terms and conditions:	Amortization period:	20 years
	Commitment period:	3.5 years
	Disbursement period:	4 years
	Interest rate:	variable
	Inspection and supervision:	1% of the loan amount
	Credit fee:	0.75% of undisbursed balances
	Currency:	U.S. dollars under the Single Currency Facility
Objectives:	<p>The program's general objective is to help increase the competitiveness of the Chilean economy by supporting technological innovation and development in strategic areas of the national economy, and their transfer to and dissemination within the entrepreneurial sector, particularly among small and medium-sized enterprises (SMEs) that produce goods or provide services. Five specific objectives have been set to attain this general objective: (i) identifying and prioritizing the basic focal points for long-term technological and production development in Chile; (ii) accelerating and encouraging the introduction of information and communications technologies in the productive sector in Chile; (iii) promoting increased competitiveness in the forestry, agriculture, and aquaculture sectors through the use of biotechnology in their processes and products; (iv) improving the environmental and productive performance of Chilean businesses, by supporting the development of cleaner production processes; and (v) encouraging Chilean businesses to adopt quality and productivity management systems.</p>	

Description:	To attain these objectives, the program will finance research and development (R&D) and technology transfer activities; the training of researchers, experts, and technicians; strengthening science and technology infrastructure and its institutional framework; and disseminating R&D activities within the country's productive sector. Through these activities, and using shared-cost mechanisms, the program is also expected to encourage private investment in science and technology.
The Bank's country and sector strategy:	The operational strategy for the Bank's action in Chile is based, among other considerations, on providing support for innovative projects that promote: (i) the private sector's competitiveness, productivity, and export capacity, particularly on the part of small and medium-sized enterprises; (ii) the modernization and decentralization of the State, and the participation of civil society; (iii) economic and physical integration; and (iv) environmental protection and the conservation of natural resources. This program is also in line with the Bank's science and technology strategy (GN-1913-3) since it will further the process of strengthening institutions in the national innovation system (SNI) as well as businesses, by supporting scientific research and developing and implementing new technologies. The Bank's participation in this program will open up new avenues for developing a joint strategy for the S&T sector, and will create opportunities to share experiences and lessons learned with the other countries in the region.
Environmental and social review:	The program has been designed to help increase competitiveness on a sustainable basis, by trying to avoid or minimize adverse environmental effects. The socioenvironmental dimension was taken into account in preparing all of the program components. The support for the development of cleaner production agreements between companies and the environmental control agency is an innovative aspect of the program, in that it turns the manufacturing sector into an ally of the process of environmental protection. Considering the possibility that some technology development activities may have a potentially adverse environmental impact, specific criteria were incorporated into the Operating Regulations to ensure that, for projects financed under the program, steps are taken to facilitate sound management of natural resources and worker hygiene and safety as well as environmental protection, concerns with labor market reform, and the lack of equal opportunity in gender-related issues. The program will have one gender expert in charge of preparing mechanisms to encourage participation by women and to include gender criteria in progress reports and evaluations. The Committee on Environment and Social Impact (CESI) reviewed this operation on 14 July 2000.

Benefits:

The proposed program will assist the country in the process of seeking, procuring, adapting, and disseminating new production and business management technologies, most of which are the responsibility of the State. The emphasis will be on taking advantage of opportunities and eliminating obstacles to technological development and competitiveness. The program takes the training of human resources into account, and is expected to increase women's involvement in the technology sector. Companies are expected to derive the benefits of providing worker training rather than to underinvest in human capital. Shortcomings in product markets will be minimized through technical assistance subsidies directed toward the quality of products, services, management, and distribution. Rather than financing primarily state R&D institutions and laboratories to develop and possibly transfer to society a series of new technologies to be used in the production of goods and services, the program will employ its resources to finance businesses seeking technology, particularly small and medium-sized enterprises, which do not have a significant chance of paying for such spending on their own. The program will also use public bidding or open window systems to support the expansion of the supply of new technological information. Additionally, strategies to improve the environmental performance of manufacturing enterprises will be implemented, using ecoefficiency as a tool for sustainable development. Quality assurance and the use of new information and communications technologies will also be introduced.

Risks:

Given the program's demand-based orientation, and the uncertainty involved in the maturation period of research and technological innovation projects, there is a risk that not all the incentives will be applied to projects with the greatest chances of success. Nonetheless, experience in Chile has shown that projects selected for Technology Funds grow more quickly than the average, and that they generate increasing social returns.

Special contractual clauses:	As conditions precedent to the first disbursement of the financing: the borrower must submit, to the Bank's satisfaction: (i) proof that the program's Executive Board (EB) has been formed and is operational, and that the necessary resources have been allocated and key personnel assigned to run it (paragraph 3.5), including the Executive Director, the Chief of Administration and Finance, the Coordinator of each of the five subprograms, and the necessary administrative support; (ii) proof that the program's Operating Regulations (OR) agreed on with the Bank have entered into effect (paragraph 3.16); (iii) proof that performance contracts have entered into effect between the executing agency and the participating organizations: the Corporación de Fomento de la Producción [Production Promotion Corporation] (CORFO), the Consejo Nacional de Investigación Científica y Tecnológica [National Council on Scientific and Technological Research] (CONICYT), and the Fundación para la Innovación Agraria [Agricultural Innovation Foundation] (FIA) (paragraph 3.2); and (iv) the operating plan for the first year of program implementation (paragraph 3.20).
Poverty-targeting and social sector classification:	This operation does not qualify as a project promoting social equality directly and in the short term, as described in the key objectives for the Bank's activities contained in the report on the Eighth General Increase in Resources (document AB-1704).
Exceptions to Bank policy:	None.
Procurement:	The Bank's standard procedures shall apply for the procurement of goods and the hiring of consultants under this program. For public-sector institutions, the procurement of goods in amounts equal to or greater than the equivalent of US\$350,000 and contracting for services in amounts greater than the equivalent of US\$200,000 will be done by means of international competitive bidding. The program does not call for the construction of any public works or new buildings. The program's projects may include financing for small expansions or modifications of existing structures for the installation of hardware at a cost not exceeding 30% of the overall cost of the project subsidy. The procurement of goods and the hiring of consultants by private-sector enterprises will be handled in compliance with the Bank's standards for the private sector. When the procurement involves services of individual consultants in amounts less than the equivalent of US\$50,000, the services of consulting firms in amounts less than the equivalent of US\$100,000, and goods and services valued at less than US\$150,000, the Bank will verify such contracting and procurement by ex-post random sampling.

I. BACKGROUND

A. Macroeconomic situation

- 1.1 In 1999, following 15 years of rapid and continuous growth at an annual rate of 6.5%, Chile suffered a period of economic contraction that had a profoundly negative impact. Real GDP growth fell from 3.4% in 1998 to -1.1% in 1999. Unemployment rose to 10%, and domestic consumption, industrial production, and tax revenues were down considerably. At the end of 1999, the peak of the recession seemed to have passed, and projections for 2000 show signs of recovery. GDP growth is expected to be 6%.
- 1.2 Given the structural limits of domestic demand, Chile's economic, industrial, and job growth depends largely on its performance in international markets. Historically, Chile's exports have been concentrated in the mining sector. However, in the last decade the export base has expanded, particularly through a range of non-traditional products: pulp and paper, wine, fish meal, fish, and fresh fruit. Chile's exports grew at an average rate of approximately 10-11% from 1994 to 1998, boosting the GDP growth rate. Despite this excellent performance, Chile's export base remains intensively focused on the natural resources sector, which may have a long-term negative effect on the country's development prospects. The challenge for Chile's productive and commercial system is not to replace production and exports of natural resource with manufactured products, but rather to develop a strategy that combines increases in productive and export diversification with the addition of value to production and exports based on natural resources. The proposed program is in keeping with this strategy.

B. Chile's background in the S&T sector

- 1.3 In the 1990s, the central elements of **Chile's technology policy** were the Science and Technology Program (1992-1995) and its successor, the Technological Innovation Program (PIT) (1996-2000). These two programs, the first of which was implemented with the support of an IDB credit, have provided a broad foundation of policy instruments, experiences, and lessons on which this new Technology Development and Innovation Program (PDIT) is built.
- 1.4 Various evaluations¹ of these programs have revealed positive trends that, while still emerging, show favorable prospects for achieving the objectives of the

¹ See *Final Report: Performance Evaluation of the Technological Funds System*, a study prepared for the Executive Secretariat of PIT, MINECON, August 1999; INVERTEC ICT, *Evaluation of Chile's Technological Funds Policy and System*, December 1999; IDB Final Evaluation, *Project Performance Review*, Science and Technology Program Evaluation, Evaluation Office, Washington, D.C., Oct. 1997.

program proposed here. Various surveys² show that from 1992 to 1999, Chile's industrial sector experienced a significant surge in technological innovation. There has also been a sharp increase in the country's technology infrastructure in recent years³, with significant investment of resources in updating and/or establishing technology research, development and transfer centers, in the public and private sectors.

- 1.5 In the area of intellectual property, Chile is engaged in a trailblazing effort in Latin America to adapt its legal tools to suit the open competition model and the global trading of its products. One example of this effort is Law 19.030, which establishes standards applicable to industrial privileges and the protection of industrial property rights, along with the relevant regulations that, in 1991, replaced the obsolete standards then in effect. Chile relies on Law No. 17.336 and the relevant regulations in terms of intellectual property protections. Three bills have been introduced in the Chilean Congress that aim to make this system easier and more attractive for researchers and businesses. One of these bills modifies Law 19.030 regarding industrial property, adapting it to the standards of the Agreement on Trade-Related Aspects of Intellectual Property Rights of the World Trade Organization ("TRIPS"). The second bill, among other things, modifies Law 17.336 on intellectual property, to adapt it to the TRIPS Agreement, as well. The third bill seeks to modify the institutionality of the industrial property system, creating an Institution of Industrial Property that has greater operational flexibility and resource management capacity.
- 1.6 The National Innovation System (SNI) is composed of all the public and private agents involved in such processes as the creation and domestic transformation of technology, technology transfer, the development of technical skills in human resources, and the dissemination of technology. In Chile, the **Technological Funds System** is the central element of the government's technology policy. It plays a fundamental role within the SNI. This system, structured primarily under the Science and Technology Program (IDB-I), consists of three main funds: (i) the National Fund for the Support of Scientific and Technological Development (FONDECYT), which already existed when the program began but was strengthened to support basic science and technology research projects; (ii) the Fund for the Support of Scientific and Technological Development (FONDEF), created to build and develop the specialized capacities of scientific and technological institutions in specific priority areas, which is a part of CONICYT and finances scientific and technological R&D projects and technology infrastructure projects at universities and technology centers affiliated with businesses; and (iii) the National Fund for Technological and Productive

² National Statistics Institute (INE) and Technology Innovation Program, "Surveys on Innovation in Chile's Manufacturing Industry, 1995 and 1998".

³ See Technology Innovation Program, Directories of Science and Technology Centers, 1997 and 2000.

Development (FONTEC), which is part of CORFO and deals with financing technology innovation projects in private enterprises.

- 1.7 Subsequently, three new funds were added: (i) the Development and Innovation Fund (FDI) which is part of CORFO and deals with promoting initiatives that make significant contributions to creating and managing technological innovation processes; (ii) the Agricultural Innovation Foundation (FIA), which supports and promotes the transformation of agriculture and the rural economy by financing technological innovation and research initiatives; and (iii) the recently established Mining Research Fund (FIM), which supports scientific and technological research related to copper and its byproducts.
- 1.8 The existing system of technology funds has been operating successfully and competitively through periodic biddings or open window systems. The present system for evaluating these funds has shown that the economic and social impact of hits financing lines has been positive, as has been its efficiency in allocating available resources. Three PIT funds—FONTEC, FONDEF, and FDI—have been the subject of recent economic evaluations. In each case, the evaluations have shown that the social benefits produced are highly favorable. They also indicate that the returns are sufficient to cover the initial investment and that the funds are functioning properly.
- 1.9 The full operation of these funds systems, and the fact that since 1996 domestic budgetary resources have wholly financed the system, highlights significant institutional dynamism. Nonetheless, the scale of operations of these technology funds is still very small in relation to Chile's needs. Therefore greater efforts must be made to make technological innovation a primary focus of the country's development agenda. In this regard, the economic analysis of the program shows that demand for available financing resources outstrips the supply⁴.
- 1.10 The proposed program is based on the existing technology funds. Therefore, this system will continue to play a central role within the new program, since it will provide the key instruments for financing the program's activities. Table I-1 indicates the main funds and other mechanisms for promoting technology development that will be used under the program.

⁴ See Gustavo Crespi and Tomás Rau, *Economic Analysis of the Technological Innovation Program*, Department of Economics, University of Chile, July 2000.

TABLE I-1 Existing mechanisms to promote the technology development and innovation to be used under the program				
Mechanism	Objective	Lines of financing	Beneficiaries	Type of bidding
FONTEC (CORFO)	Promote and finance innovation, associative transfer, and technology infrastructure procurement projects carried out by private companies and to support the productive scaling of projects derived from an innovative process	<ul style="list-style-type: none"> • Technology innovation • Technological infrastructure • Missions and consultancies • Technology transfer centers • Reinvestment studies 	Private companies	Open window All sectors
FONDEF (CONICYT)	Contribute through the strengthening of national scientific and technological capacity to the development of competitiveness of the principal sectors on the national economy, by developing linkages with centers of R&D such as universities and technology institutes and companies	<ul style="list-style-type: none"> • Technology development and research • Scientific and technological development and research • Infrastructure • Technology transfer • Staff mobility 	R&D institutions (universities, R&D centers). etc.) with input from private sector	Annual competitions Presentation by priority area (except services and construction)
FDI (CORFO)	Promote initiatives that help generate and manage processes of innovation and technological change in areas having a strategic impact on the country's economic and social development	<ul style="list-style-type: none"> • Technology development • Technology transfer • New technology capabilities (human resources, technological infrastructure, and information) • Technology and information market development 	Technological institutes and centers, technology consortia (technological entity and corporate group)	Open competitions Thematic or regional competitions Open window bidding (new facility)
FIA (MINISTRY OF AGRIC.)	Foster and promote the transformation of the rural economy and agriculture in Chile by encouraging the development of competitive advantages in agricultural production	<ul style="list-style-type: none"> • Technology innovation, agricultural diversification, and genetic renewal projects • Technology capture through information tours and highly specialized consultants • Information in support of innovation 	Universities, R&D institutes, companies	Open competitions Open window Bidding Thematic competitions
Technical assistance fund (FAT) CORFO	Support, through specialized experts, the incorporation of corporate operating management methods or new technologies in the production process as a means of improving competitiveness	<ul style="list-style-type: none"> • Individual FAT (single company) • Group FAT (3 or more companies) 	SMEs (annual sales between US\$65,000 and US\$2.8 million)	Open window
Management Support Program (PAG) (CORFO)	Support increased competitiveness of manufacturing companies, by improving Productivity and quality through process consultants	<p>Two stages</p> <ul style="list-style-type: none"> • Diagnostic: full analysis of Productivity and quality levels in the company's different operational areas • Development: carry out proposed change that will make it possible to optimize company management 	Companies with annual sales between US\$3 million and US\$30 million	Open window

Supplier development program (CORFO)		<ul style="list-style-type: none"> Two stages • Diagnostic: full analysis of Productivity and quality levels in the company's different operational areas • Development: carry out proposed change that will make it possible to optimize company management 	Client company: annual sales over US\$2.8 million Supplier companies: annual sales between US\$65,000 and US\$2.8 million	Open window
Associative development projects (PROFOS)	Support increased competitiveness of a group of companies that are prepared to commit to a shared management and marketing project	<ul style="list-style-type: none"> • Project preparation • Project development • Specific projects 	At least 5 SMEs (annual sales between US\$65,000 and US\$2.8 million)	Open window
National postgraduate study grant program (CONICYT)	Provide funding for Chilean or foreign students to pursue studies at doctorate and master's level at Chilean universities (maybe extended to foreign universities)	<ul style="list-style-type: none"> • Doctorate • Master's • Other (specialization, internships, etc.) 	Chilean students or foreign residents	Competitions

1.11 **Availability of financing for businesses.** Investment in R&D entails greater uncertainty than other sorts of investments, as well as problems with imbalances in information and the possibility of opportunist behavior. For that reason, financing of R&D activities requires more advanced financial and capital markets than those that exist in countries such as Chile. Therefore, CORFO is endeavoring to raise resources from private financial institutions in an effort to encourage investment in technology through venture capital fund facilities and credit insurance cofinancing instruments for SMEs. However, support from Chile's financial system for financing of high-technology productive projects is still limited owing to the high risk involved and the relatively long maturation periods, a situation that affects SMEs in particular.

1.12 Chile's technology and credit policy has addressed the deficiencies in the financial markets through various tools for financing and supporting SMEs. Aside from the technological funds described above, which function as co-financing instruments for projects, CORFO offers a number of medium and long-term lines of credit through banks and financial institutions, such as the Bank's Multisector Credit Program, which provides continuity in subsequent investment phases to the program's innovative activities. CORFO's⁵ main lines of financing include: (i) financing for the lease of Chilean capital goods with the option to buy; (ii) financing SME investments in fixed assets; (iii) financing of CORFO-Germany small industry investments; (iv) financing for foreign buyers of Chilean durable goods and engineering services; and (v) financing for production supplies and marketing abroad. Additionally, through the Business Development Investment Funds (FIDES), CORFO administers instruments for long-term financing, by contributing venture capital, of new or existing SMEs that generate products or

⁵ As of 1991, CORFO no longer provides first-tier credits; it transferred functions previously performed by the State to the private banking sector, to which, from a second-tier position, it provides long-term credit resources to lend to SMEs.

services with a high aggregate value, or that are technology-based. There is also a cofinancing instrument with incentive payments for securing credits for small-scale entrepreneurs, and a personal surety instrument intended to serve as a complement to the guarantees required by financial institutions.

- 1.13 The Government of Chile also administers various guarantee funds such as the Guarantee Fund for Small Businesses (FOGAPE), and the Guarantee Fund for Non-Traditional Exporters (FOGAEX) to promote exports, which also complement and give continuity to program activities.

C. The state of the science and technology sector

- 1.14 The available technological indicators presented in Table I-1 show that Chile has achieved notable advances in its technological development. For example:

- (i) From 1992 to 1997 investment spending flows for the purchase of Chilean machinery and equipment, in real terms, was up an annual average of 7.9%;
- (ii) From 1992 to 1998, imports of capital goods nearly doubled, at an annual average rate, in real terms, of 11.1%;
- (iii) Foreign investment in Chile grew at an average rate of 30% during the five-year period; and
- (iv) From 1992 to 1998, high added-value industrial exports rose from 19.4% to 27.2% of total exports.

TABLE I-2
TECHNOLOGICAL INDICATORS

	1992	1993	1994	1995	1996	1997	1998	Annual growth rate
OVERALL TECHNOLOGICAL INNOVATION (TI)								
- Purchases of Chilean machinery and equipment	881	962	846	1,026	1,215	1,291	N/A	7.9%
- Imports of Capital Goods	2,697	3,153	3,325	4,145	4,617	5,313	5,073	11.1%
- Direct Foreign Investment (flow)	940	1,035	2,476	2,642	4,177	4,885	4,541	30.0%
<i>Industry</i>	13%	31%	19%	30%	15%	14%	19%	-
<i>Mining</i>	34%	29%	32%	46%	63%	45%	21%	-
<i>Services</i>	48%	27%	34%	16%	11%	15%	41%	-
<i>Transportation and telecommunications</i>	1%	4%	7%	3%	4%	17%	10%	-
<i>Other (includes agriculture, construction, electricity, gas and water, fishing and forestry)</i>	4%	8%	7%	4%	7%	9%	10%	-
TI INTENDED FOR MORE SOPHISTICATED MARKETS								
- Secondary processing industrial exports	1,553	1,986	1,998	1,983	2,630	2,907	3,643	15.3%
(as a percentage of total exports)	19.4%	23.6%	22.1%	19.2%	23.1%	22.7%	27.2%	-
- Direct Chilean investments abroad (flow)	555	558	1,087	840	1,240	1,917	2,820	31.1%
- Number of exporting companies	5,453	5,469	5,844	5,817	5,839	5,767	5,847	1.2%
- Number of export markets (countries)	155	151	141	157	168	170	172	1.7%
HUMAN RESOURCES ASSOCIATED WITH TI								
- Number of engineers graduated per year (flow)	2,390	2,502	3,263	2,783	3,363	3,923	N/A	10.4%
- Number of postgraduate degrees granted per year	359	411	464	492	642	705	N/A	14.5%
- Number of workers trained (flow)	322,029	361,132	421,875	438,240	482,303	512,531	522,768	10.2%
- Number of research scientists and engineers (total)	5,860	6,028	6,223	6,388	6,619	6,807	N/A	3.0%
(per 1,000 T.F. components)	1.13	1.10	1.12	1.15	1.18	1.20	N/A	-
TI ACQUIRED								
- Total number of patents filed	1,127	1,682	2,006	2,081	2,383	2,920	3,114	18.5%
Filed by Chilean companies	178	342	415	324	359	275	305	9.4%
Filed by companies elsewhere in the world	949	1,340	1,591	1,757	2,024	2,645	2,809	19.8%
- Total number of patents granted	456	315	215	221	283	405	614	5.1%
Granted to Chilean companies	42	38	51	42	46	37	42	0.0%
Granted to companies elsewhere in the world	414	277	164	179	237	368	572	5.5%
- Spending on royalties	N/A	N/A	N/A	65	75	69	65	0.2%
HARDWARE, SOFTWARE, AND INFRASTRUCTURE								
- Number of computers per 1,000 inhabitants	16.8	21.4	26.2	33.0	37.9	44.4	50.3	20.0%
- Number of telephone lines per 1,000 inhabitants	96	109	116	132	156	182	204	13.4%
- No. of mobile telephone subscribers per 1,000 inhabitants	5	6	8	14	22	28	65	54.2%
- Number of Internet servers (total)			1,703	6,664	13,239	19,168	22,889	91.5%
- Number of households with cable TV	N/A	156,430	279,234	487,578	538,298	639,537	701,056	35.0%

1.15 With regard to spending on R&D, the ultimate indicator of national dynamism as a reflection of "endogenous" efforts within the country to adapt acquired technologies and to develop them in accordance with Chile's needs, the indicators show that this spending has doubled in constant terms over the 1990-1998 period⁶. Spending on

⁶ Crespi and Rau.

R&D grew at a real annual rate of 9.7%, from 84 billion pesos to 178 billion pesos. In relative terms, as shown in Table I-3, R&D spending has increased from 0.57% to 0.65 percent of GDP over that period, indicating a growth rate 15% higher than GDP growth for the same period. Some of this growth may be attributed to the private sector, whose share of R&D spending increased from 24% in 1990 to 30% in 1998. Other statistics also show an annual growth rate in the total number of patent applications filed and patents granted of 18.5% and 5.1%, respectively, from 1992 to 1998.

TABLE I-3. FINANCING OF PUBLIC AND PRIVATE SPENDING ON RESEARCH AND DEVELOPMENT (in millions of \$1998)							
Year	Public Spending	Private Spending	Country Total	% GDP	Private Share	% Flow	% Capital
1990	77,242.01	24,290.68	101,532.69	0.57	23.92%	0.94	0.06
1991	78,124.90	23,629.41	101,754.31	0.53	23.22%	0.94	0.06
1992	83,244.62	28,012.51	111,257.13	0.52	25.18%	0.80	0.20
1993	107,026.57	39,874.11	146,900.68	0.64	27.14%	0.82	0.18
1994	136,415.27	38,527.30	174,942.57	0.70	22.02%	0.91	0.09
1995	143,339.23	43,810.60	187,149.83	0.67	23.41%	0.91	0.09
1996	136,428.22	56,484.50	192,912.72	0.67	29.28%	0.89	0.11
1997	141,909.50	63,137.50	205,047.41	0.66	30.79%	0.90	0.10
1998	146,833.71	61,271.70	208,105.41	0.65	29.44%	0.94	0.06

Source: Mideplan 2000

- 1.16 In terms of the development of the human resources that are essential for consolidating gains made in technological capacity, the most suitable indicators relate to two complementary factors: (a) worker training through the National Training and Employment Department (SENCE), which gives a sense of scope of the institutionalized national training effort; and (b) the annual training and total number of engineers, which presents a general picture of training efforts in the more technical production-related professions.
- 1.17 From 1992 to 1998, the number of workers trained through SENCE grew at an average rate of 10%, reaching 522,000. This indicates that the proportion of trained worked increased to at least 9.5% of the workforce in the period under review, since training not financed via SENCE, such as public sector training for example, must be added to the figures for workers trained through SENCE exemptions and scholarships.
- 1.18 In the other type of indicator, the number of engineers graduated per year increased from 2,390 in 1992 to 3,923 in 1997. Accurate figures for 1998 are not available. Similarly, the number of research scientists and engineers (total) increased from

5,860 in 1992 to 6,807 in 1997. Of these scientists, only 350 to 400 provide services to revenue-earning enterprises, while the bulk of highly qualified personnel are located at universities and technological institutes.

- 1.19 Despite these significant advances, Chile still has far to go in order to achieve a pace and intensity of innovation that will ensure increases in productivity in line with the country's socioeconomic development needs. The national R&D effort falls short of the level attained in industrialized countries. Significantly, Chile's R&D spending is less than that of countries with factors and geographical situations similar to those of Chile, such as Finland and New Zealand. This means that the State's continued action remains essential in terms of promoting, strengthening, and accelerating the essentially private initiatives of creating, adapting, and transferring technologies, by designing and implementing a range of technology policy instruments.

D. Program conceptualization

- 1.20 The new Government of Chile has stated that technological progress is one of its highest priorities, and as one of its goals has proposed increasing national investment in R&D to 1.2% of GDP for 2006. To attain this objective, the government has sought the Bank's backing to finance a program that supports government initiatives to strengthen, expand, and accelerate the pace of development in key sectors of the country's technological and productive system, such as the plan entitled "Chile: Toward the Information Society" and the policy for the promotion of cleaner production.
- 1.21 The proposed program includes activities that seek to strengthen and accelerate technological activities in strategic areas such as quality, ecoefficiency, and information and communications technologies, and in the forestry, agroforestry, and aquaculture sectors that are priorities for Chile owing to the competitive advantages that they offer. All of these activities in support of the program are basically aimed at increasing, expanding, and speeding up participation by the private sector in national technological development in production. Accordingly, most of the program activities, such as financing for R&D projects through technology development funds and human resources training, are designed to respond to the **demand** by companies and institutions in the private sector in strategic areas and sectors of priority.
- 1.22 **Program rationale.** The great strides achieved in Chile's technology policy in the 1990s thanks to the Science and Technology Program contributed significantly to creating a set of instruments for promoting scientific and technological activities in the country. In the second half of the 1990s, the instruments of Chile's technology policy were financed solely with national resources, maintaining the original spirit of the IDB-I program, designing and using neutral instruments to support the national innovation system. However, although progress has been achieved, it has not been sufficient to create a critical mass of research institutions and enterprises that, on their own, can energize the country's processes of innovation. Additionally,

the impact of the economic crisis in the late 1990s halted temporarily the growing trend toward public support for technological innovation. Therefore, a new and major effort to stimulate innovation and technological development in Chile now needs outside financial support.

- 1.23 Chile's scientific and technological development must take into account the balance between proposals concerning the national and universal store of knowledge and proposals relating to productive applications that seek to increase the productivity, competitiveness, and quality of life of its people. In some areas, there are significant imbalances in Chile that must be corrected. For example, while Chile's scientific output in the area of the biological sciences is relatively significant, the development of biotechnology applications in the productive sector is at an embryonic stage. This demonstrates the need to adopt an integrated approach to scientific and technological issues, innovation in technology, and the transfer and dissemination of these technologies to enterprises in Chile's productive sector. The needs, challenges, and opportunities underlying the conceptualization of the program are described and summed up below in Table I-4.
- 1.24 **Need for prospective technological study.** Experiences with the science and technology programs, along with the lessons to be learned from the experiences of other countries, have convinced the Chilean government that an appropriate technological policy must combine instruments that offer general promotion of innovation and technological development (the horizontal dimension of technological policy) with specific strategies aimed at stimulating areas that are the pillars of the country's productive and competitive development.
- 1.25 However, priority areas for technological development in Chile cannot be selected based on relatively arbitrary choices by government authorities, or incomplete information derived exclusively from recent local experience. These choices may be made in such a way that they hinder the emergence of new ideas, projects, and innovation initiatives on the part of those involved in the SNI, and they may not necessarily respond to any predetermined priorities. Defining and identifying these choices must be done through processes and methods that ensure the inclusion of different visions that now exist within the national community with regard to Chile's future development.
- 1.26 Therefore, existing horizontal technological and productive policy instruments must be complemented and enhanced, and even replaced. A set of areas where competitive advantages can be created or expanded must be identified and defined. Once these have been identified, medium and long-term productive and technological development programs must be designed along these lines. During

this process of *prospective technological study*⁷, the State, in joint agreement with the private sector and the research institutions, must define an agenda of strategic issues for Chile's socioeconomic development, and must address those issues in an integrated manner, including resources, institutionality, and procedures.

TABLE I-4
STRATEGIC CHALLENGES AND PROGRAM ACTIVITIES

Problems/Needs	Strategy	Proposed Activities
Need to identify topical areas, sectors, and/or regions where national technology efforts will be focused.	Consult and reach consensus on strategic areas and medium and long-term programs with all relevant players in the national innovation system.	Prospective Technological Studies Subprogram.
Close the gaps in productivity and competitiveness that separate Chile's SMEs from the rest of the national and global economy.	Promote the incorporation and use in SMEs of information technologies, preventive environmental management technologies and methods, and quality management models.	Financing technical assistance, training, and technology transfer programs, and programs supporting innovation (ICT, Environmental Management, and Quality Management subprograms).
Inadequate technological development in areas that are now pillars of national productive development.	Support enterprises, research institutions, and universities in research, development, and technological innovation projects and programs in these areas.	Financing R&D and technological innovation projects in the areas of information technology, biotechnology, and cleaner production technologies (ICT, Biotechnology, and Environmental Management subprograms).
Need to add value and ensure the sustainability of products derived from the exploitation of Chile's main natural resources.	Promote a national biotechnology development program.	Training of human resources, financing R&D projects and innovation in biotechnology, and establishing a national working committee on biotechnology.
Inadequate number of individuals with sufficient training to implement projects, serve as consultants to enterprises, and adopt new technologies in the selected areas.	Contribute financially to creating national human resources training programs at various levels, and to operating overseas study programs.	Training of highly qualified researchers and experts (ICT and Biotechnology subprograms); training and accreditation of consultants to support enterprises (ICT, Environmental Management, and Quality subprograms); specific training in short courses and internships for civil service personnel (ICT, Biotechnology, Environmental Management, and Quality subprograms).
Lack of mechanisms to support the creation and consolidation of technology-based enterprises.	Support the creation of enterprises, technically and financially, based on successful innovation projects.	Creation and use of a public instrument (within CORFO) to support the incubation and creation of new technology-based enterprises, particularly in the ICT and Biotechnology sectors.

- 1.27 **Main challenges and opportunities in the ICT sector.** The new information and communications technologies (ICTs) are one of the main engines driving productivity and economic growth. For enterprises, the Internet offers a large number of applications ranging from efficient use of e-mail to accessing new sources of information, consultancy, and technology transfer, as well as the creation of complex e-commerce sales platforms that provide access to a broader client base and create new forms of feedback concerning demand, while greatly reducing transaction costs.

⁷ Prospective Technological Studies is based on the "Foresight" programs that certain Scandinavian countries and New Zealand, among others, have developed, using participatory processes to define policies and develop long-term consensus-based strategies for the country's technological development.

1.28 A recent Harvard University study⁸ points out that Chile has not yet managed to promote the use of new information technologies in a decisive way, which, among other benefits, could reduce the competitive obstacle posed by the country's remoteness from international markets. In July 1998, the Presidential Commission on New Information and Communications Technologies was formed to propose specific strategic guidelines and initiatives for developing information and communications technologies in the country. The Commission identified the following four shortcomings in Chile's information infrastructure:

- (i) the lack of access "is extremely imbalanced geographically and socially, since access is concentrated mainly in the capital, and most users are among the richest 10% of the population, in large enterprises, and in the central institutions of the government";
- (ii) the rapid computerization of enterprises stands in contrast to their slow integration into digital information networks for conducting business, due in no small measure to the fact that there is still no adequate legislation governing e-commerce, nor a flexible and efficient regulatory framework to foster greater competition and transparency in the services market;
- (iii) computerization of the public sector is inconsistent and disorganized, which is delaying the building of a government information highway connected to the Internet to facilitate access by citizens and enterprises; and
- (iv) the significant shortfall in terms of the quality and scope of Chilean content in digital information networks, particularly on the Internet.

1.29 **Opportunities in the forestry, agriculture, and aquaculture sectors.** Agricultural and forestry production in Chile accounts for 5.9% of GDP, and in 1999 contributed 29.7% of all exports. On the other hand, exports in the aquaculture sector for the same year totaled US\$892 million, equaling 5.7% of all exports. Although these sectors have played a fundamental role in the economy's expansion, greater efforts must be made to address growing global competitiveness, and to ensure that the comparative advantages that have been achieved are maintained, while complying with the free trade agreements and international conventions that Chile has signed, including those governing the protection of biodiversity.

⁸ Jeffrey D. Sachs et al., *A Structural Analysis of Chile's Long-Term Growth: History, Prospects, and Implications*, written by the Harvard Institute for International Development for the Government of Chile, 1999.

- 1.30 A 1995 analysis by FAO of the situation in the biotechnology sector and a 2000 study of the biotechnology industry in Chile undertaken with German support show that the human and physical resources now available in Chile are inadequate, and that fruitful cooperation has gradually taken shape between the research organizations that generate technology and the enterprises that use it for commercial purposes. Similarly, in the context of preparatory work for the proposed program, in June 2000 the Ministry of Economy, FIA, CORFO, and the National Agricultural Research Institute (INIA) conducted a survey among 60 public and private sector experts in this area.
- 1.31 Based on these studies and the survey, it is possible to conclude that in order to take advantage of opportunities and to stem the possible flight of Chile's experts in the biotechnology sector, work must proceed in several fields at once:
- (i) increasing the financing of projects for enterprises and research institutions whose new technology developments are promising;
 - (ii) promoting seed capital for promising new enterprises in this field, to increase their critical mass and competitiveness for development of this sector in Chile;
 - (iii) investing in the training of human capital in this sector in the scientific and entrepreneurial areas;
 - (iv) establishing a new policy and strategy, for which consensus is to be built by means of a national forum;
 - (v) strengthening the various information management means, through networks, databases, and strengthening the information systems in libraries; and
 - (vi) disseminating the information obtained within the scientific.
- 1.32 Accordingly, it is fundamentally important that a program be developed for Chile in this area, taking full advantage of niche markets and strategic positions for its biotechnology products, technologies, and patents in the international context.
- 1.33 **Problems and challenges in an environmental management.** In the productive sector, environmental sustainability and the competitiveness of Chile's productive sector are challenges that the great diversity of productive activities and the predominance of small, medium-sized, and microenterprises, which account for 98.5% of Chilean enterprises, must take into account. The traditional role that the State plays through environmental regulations must be complemented by the role of enterprises in adopting a preventive environmental management strategy that minimizes emissions and waste in productive processes, and uses resources efficiently.

- 1.34 Along these lines, in late 1997 the government made a commitment to give fresh impetus to a policy that promotes cleaner production, in order to boost the increase in competitiveness and environmental performance of enterprises, supporting the development of cleaner production processes while prioritizing the prevention, rather than the correction, of environmental problems. Since that time, significant advances have been made, including: (i) the creation of co-ordination, dialogue, and action forums for implementing and fine-tuning environmental management policy; (ii) the development of Cleaner Production Agreements that are intended to serve as an environmental policy instrument which seeks to achieve specific environmental objectives within a predetermined period of time, based on an agreement reached between industry and the relevant government office (regulatory, supervisory, or promotion-oriented services), or based on a unilateral declaration by industry⁹; and (iii) the development of technology centers to support Chilean enterprises in their search for solutions to environmental problems.
- 1.35 Given the diversity of the productive sector, the aim is to pursue a preventive environmental management strategy the objective of which is to minimize emissions, use material and energy resources efficiently, prevent industrial accidents, protect worker health, thereby reducing costs and complying with international standards, and becoming more competitive in the domestic and global marketplace.
- 1.36 **Problems and needs in the area of quality.** Chile's model of growth tied to natural resources has begun to show signs of exhaustion; therefore the country is actively seeking other approaches that will allow it to maintain its international competitiveness. This is why the government is encouraging the increasing use, within the national productive system, of instruments such as efficient administration schemes, the use of technical standards, accredited certification, and the use of metrology, which definitively contribute to improving the quality of the processes and products of enterprises.
- 1.37 Nonetheless, Chile is far behind in these areas. The culture of customer satisfaction is not yet sufficiently widespread. A national quality movement has not yet taken shape as it has in other countries where this has been a critical factor in disseminating entrepreneurial best practices. Similarly, consumers are not organized effectively to demand quality. This shortcoming is reflected, for example, in the fact that since the National Quality Award process began four years ago, only

⁹ The Cleaner Production Agreements are significant innovation in terms of public policy in Chile, since it is entirely possible to use the methodology developed here in other areas of government management. One of the notable contributions that these agreements make is that they minimize the controversial nature of the environmental issue, allowing it to be transformed into an opportunity in which the various players contribute the best of their skills and abilities, creating synergies and positive externalities at various levels.

60 enterprises have applied and demonstrated a management based on this model. Likewise, although Chile was the second Latin American country to adopt the ISO 9000 standard in 1991, presently the country has only a few more than 200 enterprises certified in accordance with that standard. On the other hand, Chile has a total of approximately 2,200 technical standards, and has recently begun a process that will allow it to establish national standards and international traceability in the field of metrology. By comparison, Brazil has over 8,800 standards and Argentina over 7,000.

- 1.38 In summary, the country must make significant progress in disseminating a national culture emphasizing quality and productivity, factors that are essential to improve competitiveness. In order to move forward on this issue, the National Institute of Standardization (INN), the National Productivity and Quality Center (CNPC), and CORFO have sponsored a set of initiatives to promote improvements in enterprise competitiveness based on greater quality and productivity, and they have developed a range of instruments that promote these management models within enterprises.

E. The Bank's experience in previous operations

- 1.39 The Bank's involvement in the science and technology sector in Chile began with the Science and Technology Program (672/OC-CH), approved by the Board of Executive Directors in January 1992, the final disbursement of which took place in August 1995. The loan was canceled at the request of the Government of Chile because the economic situation enabled the country to continue and expand the program using its own resources. The main conclusion of the ex-post evaluation conducted by OVE and published in October 1997 was that the program was very successful¹⁰ and that it initiated a process of bringing the scientific and technological community closer to the productive sector, improving scientific infrastructure and promoting the development of human resources at universities. Additionally, the financial participation of enterprises in projects financed by FONTEC was 49% during the Bank's program from 1992 to 1995, and rose to 65% in 1998, evidence of the program's effectiveness as a catalyst.
- 1.40 The Science and Technology Program enabled Chile to invent efficient and the instruments to continue developing the S&T sector. The Bank's loan also made it possible to create and administer governmental agencies as part of the SNI, agencies with the capacity to promote basic and applied research within enterprises. FONTEC demonstrated an outstanding capacity for execution, and FONDEF and FONDECYT enjoyed an excellent reputation for their activities and their peer review-based project selection process.

¹⁰ In general, the funds created within the program produced considerable economic and social returns. For example, one study estimated that NPV of FONTEC in terms of return, in respect of VAT, is 8 pesos for each peso that the fund contributed, and five pesos for FONDEF (INVERTEC, 1995). In 1996, in other evaluation, after selecting the 15 "most promising" projects among a total of more than 400 projects, concluded that the impact of these initiatives that was attributable to FONTEC clearly justified the State's investment in the fund overall (Gerens, 1996).

- 1.41 The **lessons learned** and recommendations included in the evaluations¹¹ of the Science and Technology Program, the Technology Innovation Program, and government policies implemented thereafter include: (i) promoting private-sector spending on R&D (e.g. through venture capital funds, shared costs, and tax and other incentives); (ii) increasing the scope of technology information funds and instruments for small and medium-sized enterprises; (iii) increasing incentives and support for longer-term highly innovative projects involving greater risk and uncertainty; (iv) seeking greater consistency between the innovations that are supported and sector trends in economic growth; (v) studying ways to assess the various regional tendencies and technological needs; (vi) foster a process of dialogue between the public sector and the private sector to identify the long-term objectives of technological development; (vii) improve the institutions and procedures for standardization and patent development; (viii) promoting the use of patents and certification within enterprises; (ix) fostering the ability of researchers to move between the productive and academic sectors; and (x) increase coordination between technology development funds to avoid duplications.
- 1.42 The proposed program will incorporate these lessons by supporting: (i) operational tools and strategies that promote increased private sector funding of technology innovation activities; (ii) the creation of new technology-based enterprises and the promotion of innovation activities within SMEs; (iii) longer-term financial instruments that take into account the technical, economic, and commercial characteristics of investment in technology products; (iv) ongoing information and analysis activities concerning technology development processes with regards to Chile's competitive opportunities and trends in international markets; (v) designing methodologies and institutions for cooperation between the public and private sectors in formulating technology policies; (vi) the development of institutions for metrology and technical standards; (vii) promotion of activities aimed at disseminating patents; (viii) the education and training of human resources for research and the management of innovation and priority areas, providing incentives for their ability to move between the academic and entrepreneurial sectors; and (ix) forums for ongoing coordination among the institutions of the national innovation system.

F. The Bank's strategy in the country

- 1.43 The operational strategy for the Bank's action in Chile must be based, among other things, on support for innovative projects that promote: (i) **increased competitiveness** and productivity through more effective and more efficient delivery of public services and mechanisms to support technological innovation in the private sector; (ii) **greater social and regional equity and improvements in**

¹¹ See: Inter-American Development Bank, *Chile Science and Technology Program Evaluation*, Washington, 1997. Ministry of Economy, *Performance Evaluation of the Technology Funds System*, Santiago, Chile, 1999.

the quality of life, with a focus on vulnerable groups (indigenous communities, women heads of household, young people and children in situations of risk, the elderly, victims of family violence, and the disabled); and (iii) **the modernization of the State administration** with a view to improving the delivery of public services, the **strengthening of alliances between civil society, the State and the private sector**, and **greater public participation** in the design, implementation, and evaluation of public policy.

- 1.44 The proposed program is also in line with the Bank's Science and Technology Strategy (GN-1913-3), since it will provide gains in the process of strengthening the institutions of the SNI and enterprises, by supporting scientific research and the development and application of new technologies. The proposed program's special emphasis on developing information technology (IT) fits in with the recommendations presented in the IDB's "Strategic statement" for this sector (GN-2024-3). Also, the operation is in keeping with the topics and conclusions emanating from the seminar on new forms of competitiveness, organized by the Bank in Santiago in August 2000, where it became evident that support was needed to disseminate and produce new technologies in the business sector, particularly in SMEs.
- 1.45 The Bank has been supporting entrepreneurial development in Chile through the multisector credit program (CH-0157) carried out by CORFO which provides medium- and long-term financing for SMEs. In addition, the Multilateral Investment Fund (MIF) has backed technical assistance and training projects for SMEs through the Industrial Productivity Center-CEPRI, (TC-9504144) as well as for development of and investment in small technology-based (TC-9604019) enterprises and certification of worker skills (TC-9808041) both of which are run by Chile Foundation. As to the relationship between the program and MIF projects, the execution period for the first two projects expires in the same year that the program is to begin. Therefore any complementarities produced will be sequential. Also, the activities of the worker skills certification project and the proposed operation could be mutually reinforcing since the program could apply the certification standards for technical experts, users, and administrators based on the experiences acquired by Chile Foundation with the support of the MIF.

II. THE PROGRAM

A. Objective

- 2.1 The program's general objective is to help increase the competitiveness of the Chilean economy by supporting technological innovation and development in strategic areas of the national economy, and their transfer to and dissemination within the entrepreneurial sector, particularly among SMEs that produce goods or provide services. Five strategic objectives have been set to attain this general objective: (i) identifying and prioritizing the basic focal points for long-term technological and production development in Chile; (ii) accelerating and encouraging the introduction of information and communications technologies in the productive sector in Chile; (iii) promoting increased competitiveness in the forestry, agriculture, and aquaculture sectors through the use of biotechnology in their processes and products; (iv) improving the environmental and productive performance of Chilean businesses, by supporting the implementation of cleaner production processes; and (v) encouraging Chilean businesses to adopt quality and productivity management systems. Accomplishing these goals requires that integrated programs must be deployed that include R&D activities; technology transfer; the training of researchers, experts, and technicians; strengthening science and technology infrastructure and institutionalality; and disseminating these activities within the country's productive sector.

B. Description

- 2.2 The program will include administrative activities and five subprograms in priority areas for Chile's technological development. Each of these subprograms, in turn, contains cross-sectional activities that lend consistency to the program, such as support for research and development projects, human resources training, and dissemination and communications.

1. Prospective technological studies subprogram (US\$2 million)

- 2.3 The prospective technological studies subprogram seeks to identify and prioritize a limited number of areas in the national economy in which it will design and implement strategic programs that will form the basic axes of Chile's technological and productive development over the long-term (15 to 20 years). This subprogram assumes a participative process that builds consensus and grants legitimacy to the priorities defined in it. Execution of the subprogram is contingent, as a key element of its methodology, on the formation of panels of experts and, on that basis, on consulting with broad sectors of the national community involved in each of the sectors previously identified. This subprogram will take cultural diversity and gender criteria into account in forming these panels.

- 2.4 The first component consists of *preparation and programming (US\$171,000)* activities relating to the organizational methodology platform, including the selection of an advisory team of international experts, with broad experience in prospective technological studies, the primary function of which will be to establish, in cooperation with the national team, the conceptual design and the detailed work plan for the overall prospective technological studies effort. The recommendations made in international consultants' report will include management indicators and program evaluation criteria; identification and definition of the sectors and/or areas of the national economy (technological areas) that will be the object of study during program implementation; the criteria to be used for this selection (for example, contribution to the domestic value added and employment, social impact, participation in exports, economic significance for certain regions, etc.).
- 2.5 The second component includes the *identification and prioritization of strategic areas (US\$1.73 million)* for which panels of experts will be created for each technology area, in which the various entities involved will be represented (government, press, universities, etc.); the development of a plan, a work method, and a budget for each panel; and holding a national event for launching the panels that will be widely broadcast through the communications media, which will be used to bring this initiative to the attention of the public.
- 2.6 For the third component, policy and technology teams will be created for each technology area, and *the public policy outlines for technological development in each area (US\$100,000)* will be worked out. Based on the recommendations made by the panels of experts, the policy and technology teams will draw up the basic outlines for strategic technology development programs for the various technology areas.

2. Information and communications technologies (ICTs) subprogram (US\$60 million)

- 2.7 The ICT subprogram seeks to promote and support the development and use within businesses of the new information and communications technologies, e-commerce, and the Internet. This subprogram will be an integral part of a broader government policy addressing these issues. Therefore, the consistency of this subprogram and its impact on the final objective must be viewed in conjunction with other actions of the government that are not integral parts of this loan project. Within this context, the subprogram will pursue four main lines of action or components: (a) strengthening the Technical Secretariat of the Government Committee on New Information and Communications Technologies (NICTs); (b) support for the use of ICTs in businesses; (c) the development and strengthening of the ICT sector; and (d) the Online Enterprise Information System (SIRE).
- 2.8 The Ministers' Committee on NICTs was created by presidential mandate on 28 June 2000, for the purpose of "proposing policies and supporting initiatives for the development of information infrastructure, fostering e-commerce, promoting the

content industry, expanding Internet access, accelerating public training in the use of networks, and dissemination culture and education through digital means.” In order to implement its resolutions, the Committee has an Executive Secretariat that handles coordination, evaluation, studies, and dissemination activities. The *Strengthening the Technical Secretariat (US\$2.3 million)* component will promote the establishment of an official institutional framework for the design and implementation of sector policy, with the support of: (i) evaluations to gauge and address specific situations or problems, such as State networks, simplification of procedures, digital signatures in the private sector, etc.; (ii) studies on current topics in the sector; (iii) development of a system of indicators to provide a global instrument to be shared by the entire information technology community that will make it possible to measure accurately and to show directly the changes taking place with regard to improvement in information and communications technologies in Chile; and (iv) communication and dissemination, including dissemination campaigns directed at promoting the use of NICTs, events with local and national leaders, dissemination of the Committees actions and projects in the national and specialized press, and the creation of an Internet website.

- 2.9 The *support for the use of ICTs in enterprises (US\$7.5 million)* component seeks to provide mechanisms that support and facilitate the incorporation of information technologies, particularly the Internet, within enterprises, from the most basic applications such as e-mail to more sophisticated ones such as online commercial transactions and the integration of systems between businesses. This action will include: (i) a national Infocenter¹² program to facilitate community access, and particularly access by SMEs which lack adequate infrastructure, to privately managed Internet access centers, that is, public spaces with computers connected to the Internet, training, support services, and ad hoc content; and (ii) support mechanisms, incentives, and technical assistance to carry out transformations within the enterprise that are needed to incorporate the technology and to adapt to new business models.
- 2.10 In order to *strengthen and develop the ICT sector capacity (US\$45.8 million)*, this subprogram will support: (i) a new enterprise incubation program to support the creation of new enterprises arising from innovative projects, by transferring resources to cover part of the spending and investment necessary to develop and ripen these businesses, until they find the more permanent financing needed for commercial expansion; (ii) operation of a technology transfer center to develop capacity in the ICT sector, through education and training, skills certification,

¹² To set up the Infocenters, a competitive fund will be established, with rules for participation, in which the terms and conditions, requirements, objectives, and mechanisms established for the allocation of project resources will be specified. The fund will cofinance an Infocenter's investment and startup phases under a plan for future sustainability. Importantly, the Infocenters seek to introduce, and facilitate access by, SMEs to new information technologies. Their usefulness may be temporary, that is to say the permanence of the Infocenters over time will be determined under a market-based demand model.

demonstrations of technology and applications, and project development and coordination; (iii) financing for R&D projects, technological innovation, and the development of new products in institutions and enterprises in the sector, through FONTEC, FONDEF, and FDI; and (iv) selective training of upper management to promote the development of a "critical mass" of individuals dedicated to technology work in Chile who will be internationally positioned, through internships at the world's top companies and institutions and scholarships for master's degrees and doctorates in subject areas that are relevant to Chile's technological development.

- 2.11 Finally, this subprogram will support the development of a *Virtual Online Enterprise Information System (SIRE)* (US\$4.4 million) enabling SMEs to meet their needs for external information in order to make decisions, and serving as a channel for interacting with the government in order to handle procedures and obtain information through a contact point.

3. Technological development in the forestry, agriculture, and aquaculture sectors subprogram (US\$50 million)

- 2.12 This subprogram will increase biotechnology development in the forestry, agriculture, and aquaculture sectors as a tool for improving its competitiveness, increasing the quality of products and processes and, ultimately, its added value. This subprogram is composed of three subcomponents: (a) financing biotechnology projects; (b) training human resource skills in neglected areas; and (c) strengthening support services for biotechnology.
- 2.13 The *funding for biotechnology projects* (US\$42 million) component will support projects of businesses, research institutes, and universities in the areas of biotechnology in agriculture, livestock, forestry, and aquaculture. Each project must provide for the transfer of the biotechnology that is developed to other users in Chile's economy. Projects may be submitted by companies, research institutions, or universities, either singly or in coalitions, including in alliances with international institutions; and they must provide for the dissemination of the information generated by the project.
- 2.14 The *training of human resources capacities* (US\$5.7 million) activities will promote an expansion of the critical mass needed for developing biotechnology in Chile, at the international level. These activities will include: (i) training by means of short courses and internships (1 to 3 months) for executives, experts, and technicians from biotechnology companies, research institutions, and civil servants, in Chile and abroad; (ii) training by means of international postgraduate courses of study (MS and PhD degrees) for business professionals, civil servants, and researchers at research institutions and universities; and (iii) postdoctoral studies for Chilean specialists, in association with research centers and companies, on specific topics.
- 2.15 The *strengthening technology support services* (US\$2.3 million) component is intended to generate, compile, and disseminate information about the various aspects of biotechnology. The activities will include: (i) analysis of biotechnology

policy and the strategic actions needed to carry out that policy, founded on a fundamental study now being prepared by the Ministry of Agriculture; (ii) the creation of a national biotechnology forum that may be located at the Chile Scientific Society, to hold consultations on policy and strategy; (iii) information management, through strengthening of existing public and private sector networks, databases, and libraries relating to the field; and (iv) dissemination of innovations through scientific and technical media, in addition to public awareness campaigns on the issue.

4. Environmental management in the productive sector subprogram (US\$36 million)

- 2.16 This subprogram will encourage increased competitiveness and environmental performance among businesses, supporting the development of environmental management processes, particularly relating to cleaner production, while placing greater emphasis on preventing rather than correcting environmental problems.
- 2.17 The activities of this subprogram are grouped into four components: (a) strengthening the mechanisms of public-private coordination and cooperation; (b) expansion of the information and dissemination infrastructure; (c) development of incentives and financing to promote environmental management; and (d) training of public and private capacities. The following elements are proposed for strengthening *coordination mechanisms (US\$6.7 million)*: (i) promoting the expansion of clean production agreements; (ii) expand environmental management regulation, with a view to including clean production agreements official regulations; (iii) strengthening the institutional capacity of the Public-Private Clean Production Committee by creating and fine-tuning initiatives that facilitate its development and impact on the productive sector in Chile; and (iv) developing preventive compliance monitoring units¹³ within compliance monitoring institutions.
- 2.18 The *information and dissemination infrastructure (US\$2.8 million)* component seeks to motivate the entrepreneurial sector to make changes in favor of environmental management, and is therefore a support tool that can be used in all the actions defined within the other components. The main activities to be undertaken are: (i) providing computer support for monitoring and control of cleaner production agreements; (ii) supporting initiatives that promote efficient energy use; (iii) developing a technological observation facility for monitoring and studying technological solutions and best practices at the international level, to

¹³

The "Preventive Environmental Compliance Monitoring" strategy means creating a process of systematic efforts on the part of the compliance monitoring institutions, the purpose of which is to encourage enterprises to comply with regulations without waiting for an inspection involving fines and to ensure that the resources that would otherwise be used to pay a fine are redirected toward a permanent solution to that particular environmental problem. The aim is to provide information about legal requirements and compliance monitoring procedures, and to promote self-monitoring on the part of enterprises.

support clean production agreements; (iv) promoting a dissemination and communication program.

- 2.19 In terms of *technical assistance and cofinancing (US\$18.9 million)* to promote environmental management, two lines of activity have been defined that aim to promote entrepreneurial investment in clean hard and soft technologies: (i) strengthening promotional instruments to support the use of soft technologies; and (ii) cofinancing of technology investment projects for minimizing losses.
- 2.20 The *training of human resources capacities (US\$7.6 million)* activities that this subprogram will support are: (i) cofinancing for the design and execution of study programs at Chilean universities; (ii) basic and advanced training for the public sector at the regional and sector level (courses, graduate training, etc.); (iii) training of consultants and the development of a national register of environmental management consultants that responds to the entrepreneurial sector's needs in terms of their demand for soft clean technologies; (iv) strengthening research, development, and technology transfer institutions (national clean production centers, universities, institutes, and others); (v) strengthening the national network of clean production centers by providing support for new ecoefficiency centers; and (vi) developing standards and designing a certification system for environmental management consultants.

5. Promoting quality to improve competitiveness subprogram (US\$28 million)

- 2.21 This subprogram will raise the productivity and quality of businesses, particularly SMEs, by expanding the implementation of management models based on excellence, products and processes certified under quality standards, and improvements in quality certification infrastructure. The three components of the subprogram are described below.
- 2.22 Promoting the use, particularly among SMEs, of an *excellence management and self-evaluation model (US\$11.8 million)* within companies based on the National Quality Award. Actions supporting the development of specialized consulting personnel are also included, as well as financial support to enable companies to implement quality management systems. The goal is for at least 600 enterprises, particularly SMEs, to use the model within four years; the model consists of the following elements: senior management leadership, customer satisfaction management, personnel development, strategic planning, information systems, product and service design, social contribution and environmental protection, and overall results.
- 2.23 *Promoting the use of quality management standards (ISO 9000, ISO 14000, and others) (US\$11.4 million)* in enterprises and the support needed for quality management certification. The aim is to create a capacity in Chile for management and quality consulting, and to subsidize this activity and the accredited certification of enterprises. This component is intended to provide incentives and subsidize the

quality certification of 600 new enterprises which, when combined with the 200 companies which will become certified independently and the 200 that have already been certified, will bring the total number of certified enterprises to 1,000 by the end of 2005.

- 2.24 *Expansion of quality certification infrastructure (US\$5 million)*, including the full range of existing ethical standards, the number of laboratories serving as nodes in the national metrology network, and the number of certification organizations and registered laboratories in the national accreditation system. The main goals are: (i) to increase to 500 the number of technical standards available to productive enterprises; (ii) to incorporate seven new node laboratories into the national metrology network, four in physical metrology and three in the chemical metrology; (iii) to strengthen the national accreditation system by hiring and training new professionals, seeking support from international consultants to complement the present system, and developing new areas of accreditation. Additionally, international presence must be strengthened in order to exceed to the reciprocal recognition agreements among national accreditation systems and to participate in regional and international forums where the standards that govern the global community are discussed; (iv) to strengthen the information system with regard to quality, expanding its present capacity to disseminate standardization and to develop materials specifically devised to cover specific industrial sectors.

6. Support for human capital development

- 2.25 The program will support **human resources training** activities through the four main subprograms outlined in Table II-1. The overall aim of these activities is to strengthen and generating capacity to create and innovative, to update existing knowledge, develop capacities and skills and relevant technologies that give rise to “spin-offs” in strategic areas, and to discuss and exchange experiences with specialized institutions abroad. The training and instruction activities will be coordinated by CONICYT, an institution with vast experience in these areas, which will supervise the executing agencies. The content of these activities and their specifics will be determined during the program on the basis of demand and the needs of the manufacturing and industry. The program will take cultural diversity and gender criteria into account in the various human resources training processes.

C. Scaling of the program

- 2.26 The analysis of the program's technical viability was based on an evaluation of two factors that are relevant to its success¹⁴. First, the general situation and disposition of potential clients to participate in programs of this kind were examined. Secondly, the availability of supply to meet the demand created by the program was studied.

¹⁴ See G.Crespi and T.Rau, op.cit.

TABLE II-1 HUMAN RESOURCE EDUCATION AND TRAINING ACTIVITIES			
Subprogram	Target group	Activity	Executing institution
Information and communications technologies	Researchers	Master's and doctorate	CONICYT
	Business professionals and technical experts	Training trainers and certification of technical skills	INTEC
	Consultants	Training and certification in technical skills	INTEC
Technological development in the agriculture, forestry, and aquaculture sectors	Researchers	Master's, doctorate, and post doctorate	CONICYT
	Specialists from enterprises and research institutions	Training courses	CONICYT and FIA
	Civil servants in the sector	Training courses and internships abroad	FIA
Environmental management in the productive sector	Business professionals and technical experts	Design and execution of courses of study at Chilean universities	CONICYT
	Consultants	Design and execution of courses of study at universities	CONICYT
	Civil servants in the sector	Specialization courses	Clean Production Committee
Promotion of quality	Business professionals and technical experts	Training courses	CNPC and INN
	Consultants	Modular courses	CNPC and INN

- 2.27 In light of Chile's extensive experience in administering a national system of technology funds, perhaps the most relevant information for characterizing demand within the system is the evolution of that demand during the period from 1991 to 1999 (information in the database for 1999 is incomplete), the period covered by the Science and Technology Program and the Technology Innovation Program. As shown in Table II-2, a total of 2,066 technology projects were granted financing during this period.
- 2.28 One of the most relevant aspects of the table is the high rate of growth registered in the number of projects financed. The total increased from 22 projects in 1991 to 407 in 1999. However, when this rate is analyzed by phase, growth is heavily concentrated in the period from 1991 to 1996. In that last year, the total number of projects financed came to some 300, the approximate figure at which the total number has stabilized since then.
- 2.29 In order to analyze this expansion by thematic area, the projects financed were classified in four categories that relate to the subprograms evaluated in this document. In general terms, the four categories of projects financed have evolved at the same rate as the system overall, in which they have maintained a relative share of approximately 5% to 10% in each year under consideration. In other words, the technological neutrality on the basis of which the system has operated for the past 10 years has not created any obvious bias in favor of any particular technology.

- 2.30 This finding, which is relevant during the initial phases in the evolution of a technology fund system, may not remain so in more mature phases such as those that Chile is now experiencing, in which there is now a perception that projects related to the four subprograms off for a significantly greater social return than the rest of the system. This is one of the central arguments that validate a program such as the one described in this document.

TABLE II-2 NUMBER OF PROJECTS FINANCED BY AREA IN THE TECHNOLOGY FUNDS SYSTEM (below each number, percentages by respective row and column) *						
Year	General	Cleaner Technologies	Information Technology	Quality	Biotechnology	Total
1991	17	0	3	1	1	22
	77.27	0	13.64	4.55	4.55	100
1992	86	6	12	4	9	117
	73.5	5.13	10.26	3.42	7.69	100
1993	115	6	15	9	3	148
	77.7	4.05	10.14	6.08	2.03	100
1994	111	4	8	2	7	132
	84.09	3.03	6.06	1.52	5.3	100
1995	170	9	10	9	5	203
	83.74	4.43	4.93	4.43	2.46	100
1996	258	20	14	8	19	319
	80.88	6.27	4.39	2.51	5.96	100
1997	315	16	18	18	19	386
	81.61	4.15	4.66	4.66	4.92	100
1998	276	13	15	10	18	332
	83.13	3.92	4.52	3.01	5.42	100
1999	312	27	17	30	21	407
	76.6	6.6	4.1	7.3	5.1	100
TOTAL	1.606	101	112	91	102	2,066
	80.3	4.9	5.4	4.4	4.9	100

* Figures for 1999 are preliminary

- 2.31 **The technology supply.** En 1999 a second survey was conducted among science and technology centers (STCs) to update the Directory of Science and Technology Centers. The aim was to identify and update information on all public and private centers that conduct science and technology research work in Chile, and the services that these centers provide to enterprises in this area. Table II-3 depicts the trend in the number of STCs during the Twentieth Century.
- 2.32 According to the results of the 1999 survey, there are a total of 265 STCs in Chile 88% of which are university related. Since universities are located widely across the country, the STCs are present in 12 of Chile's 13 regions. The Metropolitan Region accounts for 41% of all STCs, and has a higher relative concentration of non university-related centers.

- 2.33 The first indicator of the dynamism of Chile's technology supply is that 33.6% of the STCs responding to the survey were founded between 1990 and 1999, the most productive period in this regard. The previous period of growth occurred in the 1960s.

TABLE II-3 NUMBER OF CENTERS BY DATE OF FOUNDING								
1875 1898	1900 1939	1940 1959	1960 1969	1970 1979	1980 1989	1990 1999	No information	Total
4	16	22	27	19	47	96	34	265
1.5	6.0	8.3	10.2	7.2	17.7	36.3	12.8	100.0

- 2.34 In terms of ties to the entrepreneurial sector, 50% of all STCs said that they had good relationships with businesses. When asked about the type of relationships, fewer than half report having had any R&D-related ties to productive enterprises. The number of STCs with R&D ties to productive enterprises increased during the three-year period under consideration in the survey. However, the most common relationship is with regard to dissemination and technology transfer, following by R&D agreements. Generally, over the course of the past three years, the number of centers having contacts with enterprises grew at a significant rate, with expansion increasing at a more rapid pace for dissemination operations. It is also interesting that while contacts with large-scale enterprises with regard to dissemination and support activities have increased more than contacts with small-scale enterprises, the opposite is true for R&D agreements, where the rate of increased ties is far higher for SMEs.
- 2.35 In summary, the analysis presented in this section indicates the existence of strong pent-up demand for funds for innovation in all areas associated with the program (Paragraphs 4.5 to 4.8), and the existence of strong dynamism within the scientific community which, although it is starting from a low level, is showing significant rates of growth and productivity, indicates a high degree of probability for the technical viability of the program, since there is sufficient relevant supply and demand for channeling resources. This further highlights the important role that the program can play as a catalyst to help match supply with demand.

D. Program cost and financing

- 2.36 The cost of the program is US\$200 million, as presented in detail in Table II-4. The Bank's financing amounts to US\$100 million, and will be funded using ordinary capital resources (in dollars under the single currency facility). The periods of amortization, commitment, and disbursement of resources are 20 years, 3.5 years and 4 years respectively. The interest rate is variable, and the credit fee is 0.75% annually on undisbursed balances. The inspection and supervision rate is 1% of the loan amount. Funds will be considered committed when the agreements are signed with the project beneficiaries. The national counterpart is US\$100 million, which will be provided by the Treasury of Chile; consequently, no problems are anticipated in terms of its capacity to fulfill its obligations.

- 2.37 Given the complexity of the program, skilled personnel will be needed to coordinate the different institutional players involved and to ensure that the administrative management and control of the processes, accounting and financial management of the funds, bidding processes etc. run smoothly. To this end, a program executive board will be set in an institutional capacity with the functions outlined in paragraphs 3.1, 3.3, 3.4, and 3.5. The administrative costs over the four years of the program are estimated at US\$5 million (2.5% of the total program costs), of which 31.7% will cover payroll expenses, 36.9% studies, 18.5% dissemination, 9.2% current expenses, and 3.6% equipment).

TABLE II-4 TOTAL PROGRAM COSTS (expressed in thousands of US\$)				
CATEGORIES	IDB/OC	LOCAL COUNTER -PART GOC	TOTAL	% TOTAL
1. Administration	5,000		5,000	2.5
2. Direct costs	92,000	84,000	176,000	88.0
2.1 Prospective technology studies subprogram	1,000	1,000	2,000	1.0
2.2 Information and communications technologies subprogram	31,000	29,000	60,000	30.0
2.3 Technology development in the forestry, agriculture, and aquaculture sectors subprogram	26,000	24,000	50,000	25.0
2.4 Environmental management in the productive sector subprogram	18,000	18,000	36,000	18.0
2.5 Promoting quality to improve competitiveness subprogram	16,000	12,000	28,000	14.0
3. Concurrent costs	200	250	450	0.2
3.1 Promotion and dissemination		250	250	0.1
3.2 Auditing and evaluations	200		200	0.1
4. Financial costs	1,000	14,750	15,750	7.9
4.1 Interest		14,000	14,000	7.0
4.2 Credit fee		750	750	0.4
4.3 FIV	1,000		1,000	0.5
5. No specific appropriation and contingencies	1,800	1,000	2,800	1.4
TOTAL	100,000	100,000	200,000	100.0
% TOTAL	50%	50%	100%	

III. PROGRAM EXECUTION

A. Institutional Framework

- 3.1 The borrower is the Republic of Chile and the executing agency is the Ministry of Economy (MINECON) through its Subsecretariat of Economy which, to this end, will establish an **executive board for the project (EB)**. The institutional arrangement proposed for the program under consideration is similar to the one that the Subsecretariat of Economy recently used to execute the Technology Innovation Program. This will make it possible to draw on the experience gained in developing, financing, and executing projects in science and technology. That experience also served to identify and improve weaker institutional areas, to promote more efficient and effective program execution.
- 3.2 The Subsecretariat of Economy will be responsible to the Bank for program execution. In fulfilling this role, the Secretariat will coordinate the various institutions involved in program execution by means of **performance contracts¹⁵**, evaluate their progress, effectiveness, and impact, and make recommendations to the Budget Office (DIPRES) of the Ministry of Treasury concerning the annual allocation of resources in accordance with that evaluation. **The entry into force of these contracts is a condition precedent to the first disbursement.**
- 3.3 Senior program management and orientation will be the responsibility of the Under Secretary of Economy, Development, and Reconstruction, with the advisory assistance of a program board, composed of the Under Secretary, who will preside over the board, and the executive directors of the institutions participating in the program (the Executive Vice President of CORFO; the President of CONICYT; and the Executive Director of FIA). The functions of the board will be: to approve program evaluations; request and review technical studies relating to the program; recommend changes in the execution of the program or any of its subprograms; orient the program's dissemination activities; mediate any disputes that may arise among the coordination committees of the subprograms; issue recommendations to ensure the sustainability of post-program actions, regulate its own operations and recommend or issue opinions on changes in the Operating Regulations; and generally to ensure that the program's goals and objectives are accomplished.
- 3.4 The EB will be the technical and administrative vehicle for program management and coordination, and will be composed of an Executive Director and a small staff of technical and professional personnel, and support personnel, to coordinate program activities. The main functions of the EB are:

¹⁵ These contracts, which will be signed annually, will specify the support and resources that the participating institution will receive from the Subsecretariat, as well as the responsibilities, activities, and goals that the institution must achieve during the period of execution.

- (a) to coordinate and monitor overall execution of the program, ensuring compliance with the contract, the logical framework, and the performance contracts;
- (b) to perform the activities in the general interest specified in the program;
- (c) to contribute to the design and implementation of the government's technology policy;
- (d) to support the implementation of directives issues by the program board;
- (e) to coordinate the programs' dissemination activities, including its computer network;
- (f) to maintain an information system concerning the evolution of the program and its subprograms and components;
- (g) to participate in and coordinate the work of monitoring the program during its execution, and its evaluations;
- (h) to prepare, based on information furnished by the various coexecuting agencies, the technical and financial reports that are to be submitted to the Bank, and to provide the Bank with information it requires concerning the operational and financial control of the program, including requests for disbursement with the corresponding justification;
- (i) to perform any other appropriate tasks as defined in the Operating Regulations and the contract with the Bank;
- (j) to transfer the program resources to each of the coexecuting agencies and request the corresponding justification from the latter;
- (k) to maintain, working closely with the coexecuting agencies, a proper filing system for supporting documentation for expenses and investments charged to the program.

3.5 The executive board will have a professional **coordinator** for each of the five subprograms. These coordinators will be responsible for providing specific support to the participating institution responsible for each subprogram, in terms of conducting and streamlining the relevant components and activities. The main institutions that will participate are CORFO, CONICYT, and FIA. The executive director will be appointed by an executive committee composed of specialists with ties to the execution of the various subprograms or the issues that determine the eligibility of projects and activities. **Evidence that the executive board has been formed and is functioning with the necessary resources and staff (including the Executive Director, the Chief of Administration and Finance, the Coordinator for each of the five subprograms and the necessary support staff) will be a condition precedent to the first disbursement.**

- 3.6 Each of the coexecuting agencies will be responsible for: (i) opening separate special bank accounts for management of program resources, (ii) submitting periodic reports to the EB, (iii) establishing and maintaining proper accounting, financing, and internal audit systems that can identify at all times the sources and applications of program funds, and (iv) establishing and maintaining a proper filing system of all documentation justifying eligible program expenses. Such documentation should be available for review by Bank officials and the external auditors of the program.

B. Program Execution

- 3.7 **Participating institutions.** In addition to executing the prospective technological studies subprogram, the Secretariat of Economy, through the executive board, will be directly responsible for the execution of two of the four components of the communications and information technologies subprogram: Strengthening the technical secretariat of the NITC Committee, and the Online Enterprise Information System (SIRE).
- 3.8 CORFO will be responsible for executing the majority of the program's components and activities. First, it will serve as the coordinator and main executing agency for the two remaining components of the ICT subprogram: support for the use of ICTs in business, and development and strengthening of the ICT Sector, for which it will use its technology development funds (FONTEC and FDI), as well as its instruments for supporting the productive development of enterprises¹⁶. Additionally, CORFO, in cooperation with its National Productivity and Quality Center (CNPC) and the National Institute of Standardization (INN), will be responsible for the activities of the Quality Promotion subprogram. Finally, through its technology funds, CORFO will also cofinance technology development projects in the agriculture, forestry, and aquaculture sectors.
- 3.9 CONICYT will be the institution responsible for coordinating all actions associated with human resources training in all subprograms. Additionally, CONICYT will participate in financing research and development projects and technology transfer projects of the ICT subprograms, biotechnologies in priority sectors, and environmental management, through FONDEF, and will participate in cofinancing personnel training programs within the selected areas.
- 3.10 FIA will be responsible for some aspects of the biotechnology project financing and human resources training in areas not now being served and fully responsible for executing the technology support services strengthening component of the technology development in the agriculture, forestry, and aquaculture sectors subprogram. It will also coordinate with CORFO and CONICYT project financing and execution through the relevant technology funds.

¹⁶ Technical Assistance Fund (TAF), Associative Development Projects (PROFO), Supplier Development Program (PDP), Enterprise Management Support Program (PAG)

- 3.11 The specific responsibilities of each institution will be described in the performance contracts to be signed each year with the EB. A matrix of the main functions and responsibilities of the various agencies involved in the program as well as the promotion instruments through which the program activities will be carried out, is presented below in Table III-1.

TABLE III-1 Matrix of institutional functions and responsibilities in PDIT						
Institution	Technology innovation and development program	Prospective technology subprogram	Information and communications technologies subprograms	Technology development in the forestry, agriculture, and aquaculture sectors	Environmental management subprogram	Quality management subprogram
Ministry and Subsecretariat of Economy	Ultimately responsible for execution Chairs program board Headquarters of Executive Management; coordination, evaluation, studies, dissemination. Enters into performance contracts with coexecuting institutions	Coordinator of subprogram	Responsible for government policy on ICT In charge of SIRE and Infocenters program Participates in subprogram coordinating committee	Chairs subprogram coordinating committee	Chairs subprogram coordinating committee (CORFO cleaner production committee)	Participates in subprogram coordinating committee
CORFO	Principal executing agency of activities in support of innovation, technology, transfer, and corporate management	Participates in subprogram coordinating committee	Chairs subprogram coordinating committee R&D and innovation project financing through FDI, FONTEC, and Region VIII Fund Financing for incubation and seed capital projects	Participates in subprogram coordinating committee Financing for projects through FDI, FONTEC, and Region VIII Fund Financing for incubation and seed capital projects	Coordinator of subprogram through CORFO Cleaner Production Committee Financing for projects through FDI and FONTEC Financing for activities through development incentives	Participates in subprogram coordinating committee Financing for activities through development incentives
CONICYT	Coordinator postgraduate training activities	Participates in subprogram coordinating committee	Participates in subprogram coordinating committee Financing for projects through FONDEF Postgraduate program financing	Participates in subprogram coordinating committee Financing for projects through FONDEF Postgraduate program financing	Financing for projects through FONDEF Postgraduate program financing	

FIA		Participates in subprogram coordinating committee		Participates in subprogram coordinating committee Financing for projects, tours, consultancies, and training activities Responsible for national workshop on biotechnology, technology antenna, strengthening of public capabilities		
CNPC					Participates in subprogram coordinating committee	Chairs subprogram coordinating committee Responsible for excellence management model component
INN						Participates in subprogram coordinating committee Responsible for quality management implementation and quality infrastructure expansion components
INTEC			As Center of excellence and technology transfer carries out training and instruction activities, skills certification, demonstration center, technology antenna, project development and coordination			

- 3.12 **The program's operating strategy and instruments for promotion.** As a general criterion, the program will be executed using existing public instruments for the promotion of technological innovation and productive development, making changes to them as necessary. Among these instruments, the technology funds system (FONTEC, FONDEF, FDI, and FIA) will be the preferred instrument for channeling financing to research and development, innovation, and technology transfer activities covered in the program.
- 3.13 However, the program will have to consider creating new instruments in areas where current public mechanisms are insufficient, inadequate, or simply non-existent, such as the incubation program to support the creation of new enterprises, particularly in the information and communications technology sector, and the Region VIII innovation fund to support productive development in Region VIII.

The use and administration of resources intended for the program's activities will be governed by Operating Regulations (Technical File 14), which will include relevant standards for the appropriate execution of each activity, and by a logical framework (Annex III-1) for the implementation of the regulations.

- 3.14 The program's financial contributions to the various activities planned within it will be in the form of subsidies to the institutions or enterprises executing those activities. However, all those institutions or enterprises must make economic contributions to the respective activities, whether in the form of direct financial or asset contributions, contributions in kind and/or work and research time. The proportion of the contribution made by the executing institution will depend on the type of activities to be performed, and will be adequately specified in the Operating Regulations.
- 3.15 **Share intellectual property rights contracts.** The standards concerning intellectual property rights to the reports, procedures, and results of research and projects financed by the institutions participating in this program (CORFO, CONICYT, and FIA), are as follows: the intellectual property rights are owned by the beneficiary entity (companies, research centers, etc.) pursuant to the regulatory provisions of CONICYT and CORFO. In the case of CONICYT, it should be added that the regulatory provisions also provide for ownership to be shared by the entity benefiting from the financing and other enterprises or entities that may also have participated in the project. For projects financed by FIA, the regulations of this Foundation provide that the intellectual property rights will be held by FIA jointly with the beneficiary entity. In cases where marketable products result from financed projects, FIA will negotiate with the beneficiary entity regarding the reimbursement or contribution that it will receive from them. The foregoing notwithstanding, in conformity with its regulatory provisions, the FIA may also transfer its participation in the intellectual property rights to the beneficiary entity, and may do so for valuable consideration or without such consideration.

C. Operating Regulations

- 3.16 Execution of the program will be governed Operating Regulations containing generally applicable rules and specific rules for the subprograms. **These Operating Regulations must be placed into effect by the Ministry of Economy as a condition precedent to the first disbursement of the loan.** The regulations will contain provisions governing coordination between subprograms, their financial instruments and management, eligibility criteria and execution content for each program activity and the general guidelines and procedures for project selection, monitoring, and evaluation. Also included will be regulations for the use of resources and for Bank monitoring of the program.
- 3.17 The Operating Regulations establish that all financing for the program will be allocated by competitions that are open, by invitation, or by window. These

competitions will be held preferably through a technology fund system governed by the guidelines, regulations, and regular conditions of such funds. The rules for competition through different lines of the different technology funds will need to be in line with the rules consisting of the Operating Regulations. The financing of competitions, projects, or activities with resources from two or more subprograms, or from more than one participating institution, will be covered by interagency agreements. The Operating Regulations will further establish that for a project to be eligible for financing under the program will be conditional on fulfillment of the contractual provisions of legally applicable treaties to which Chile is a signatory in the areas of gender and environmental management, sanitation, labor matters, and indigenous affairs, to the satisfaction of the competent authority. The participating institutions and technology funds will generate records that contribute background information to the knowledge of the actual situation in these areas.

- 3.18 The Bank's standard procedures will apply for the **procurement of goods and contracting for consulting services** in this program. For public-sector institutions, the procurement of goods the procurement of goods in amounts equal to or greater than the equivalent of US\$350,000 and contracting for services in amounts greater than the equivalent of US\$200,000 will be done by means of international competitive bidding. The program does not call for the construction of any public works or new buildings. The subprograms financed with program resources may include financing for small expansions or modifications of existing structures for the installation of hardware at a cost not exceeding 30% of the overall cost of the project subsidy. The Bank's policies on private-sector procurement will apply with respect to beneficiaries in the private sector, particularly the policies relating to the appropriate, efficient, and economical use of resources, and the eligibility of goods, construction work, and services¹⁷. Therefore, competitive methods will be used, to ensure that goods and services are obtained at market rates. When the services of individual consultants are contracted for in amounts less than the equivalent of US\$50,000, the services of consulting firms in amounts less than the equivalent of US\$100,000, and procurement of goods and services in amounts less than the equivalent of US\$150,000, the Bank will verify such contracting and procurement by ex-post random sampling.
- 3.19 The Bank will supervise the critical stages of the procurement process and the administration of the resulting contracts, to safeguard the rule of economy and efficiency that applies to the use of this financing, and the efficient execution of the program, as well as the Bank's principles and policies on procurement. The Secretariat of Economy and the co-executing agencies, in turn, must cooperate with the Bank in terms of this supervision. To that end, and as part of the orderly process for the procurement of goods and the contracting of services, the Secretariat of Economy and the co-executing agencies must keep and make available to the Bank

¹⁷ In the case of the FIA, INN, and INTEC, the standard procedures used by the Bank for procurement of goods and services in the public sector will apply.

all documents and records relating to the acquisition and contract administration process.

- 3.20 **Annual Operating Plans (AOPs).** Prior to 30 November of each year for the duration of the program, the executing agency will submit the AOP prepared by the project's executive board for the following year for the Bank's consideration. The AOP will including a schedule of the activities and tasks to be accomplished in each component of the various subprograms: the monthly calendar for implementation and disbursement of resources from the financing and the local counterpart; the quarterly disbursements to be requested from the Bank; the results to be achieved in each components, and progress toward achieving the goals of the subprograms and the program as a whole. The plan will include a comparison of each of these elements with the agreements made in the program's logical framework and in the financial overview included in this report. **The AOP for the first year of execution will be a condition precedent to the first disbursement of loan resources.**

D. Execution period and disbursements, recognition of expenses, and revolving fund

- 3.21 The program will be executed over four years through annual disbursements, according to the following schedule:

TABLE III-2						
SCHEDULE OF DISBURSEMENTS						
(expressed in thousands of US\$)						
YEAR	I	II	III	IV	TOTAL	%
IDB	15,000	25,000	35,000	25,000	100,000	50
LOCAL	15,000	25,000	35,000	25,000	100,000	50
TOTAL	30,000	50,000	70,000	50,000	200,000	100
% PER YEAR	15.0	25.0	35.0	25.0	100.0	

- 3.22 **Recognition of expenditures.** The Secretariat of Economy has asked the Bank to recognize the corresponding shares of commitments allocated after 1 January 2001 as part of the program's local counterpart resources. The project team concurred with this request, to a maximum of US\$2 million, and expenditures incurred as of that date will be reviewed by the Bank. Given the expected pace of execution and the reimbursement system that has been established, it is recommended that up to 5% of the financing be advanced. The executing agency must manage these resources in a special bank account set up for the program.

E. Accounting and Auditing

- 3.23 The executive board must keep program accounts separate from the other accounts of the Secretariat. Additionally, for the period of program execution beginning with the year in which disbursements are begun, and within 120 days after the end of

each fiscal year, the executive board of the program will submit the program's financial statements audited by the Auditor General of the Republic.

F. Bank monitoring and supervision

- 3.24 Benchmarks¹⁸ have been agreed upon for monitoring the program, and these have been included in the program's logical framework, as well as monitoring activities to generate information on the program during its execution which will serve to identify any changes or adjustments that may be required in the strategic and operating mechanisms (including allocations by component) to enhance execution and ensure that the program objectives are attained. These monitoring activities will also enable government authorities and the Bank to verify compliance with the agreed terms. As part of these control and monitoring activities, resources have been earmarked for design and implementation of ongoing monitoring and evaluation of the program by means of semiannual monitoring reports. These reports will be prepared by the executive board and submitted to the Bank within two months after the date on which each year of execution is completed; and will also serve as regular progress reports. Based on these reports, joint IDB/Executive Secretariat meetings will be held within 60 days following the date on which these reports are submitted.
- 3.25 The reports will provide the necessary information for both a midterm evaluation and another evaluation when the program is well advanced, to be carried out in 18 and 42 months, respectively, after the loan has been declared eligible. Also, an ex post evaluation for the program will be performed in accordance with the Bank's standards. Given the program's innovative content and its possible dissemination elsewhere in the region, it was agreed that the ex post evaluation would be financed with funding from the Bank. **The terms of reference¹⁹ for the evaluations will be agreed on between the EB and the Bank during the six-month period before each evaluation is conducted.**

¹⁸ The logical framework will incorporate, amongst other indicators, the parameters identified in Tables I-2 and I-3 of the present document

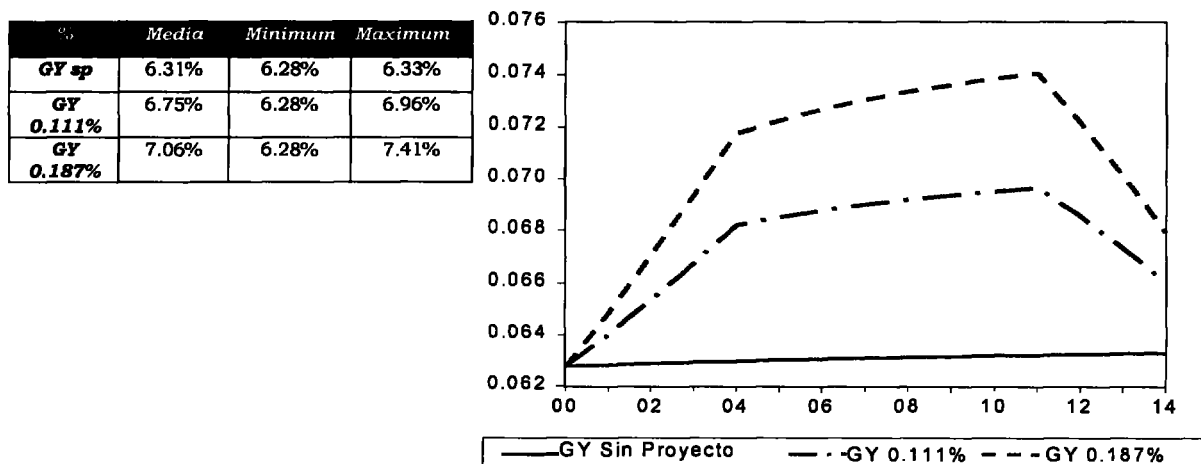
¹⁹ The terms of reference for the ex post evaluation will take into account the lessons learned from this program which may also be used in S&T programs in C and D Countries.

IV. VIABILITY AND RISKS

A. Socioeconomic viability

- 4.1 The economic analysis of the operation²⁰ has estimated the program's impact on Chile's macroeconomic growth performance. Two temporary "boosts" to growth in total factor productivity (TFP) were used in these calculations. The first assumes that each of the four years of the program's disbursements, starting in the following year, produces an increase in the rate of TFP expansion of 0.111% (this is the minimum scenario). In the second scenario, the expansion attains a rate of 0.187% (maximum scenario). It is assumed that these accelerated rates extend for 10 years, at the end of which the TFP increases are the rate expected without the project (3%)²¹.
- 4.2 Table IV-I shows the results that these two "boosts" have on GDP curves. Under the assumptions of these scenarios with regard to the productivity of innovation projects financed by the program, and under the specified macroeconomic model²², the average growth in GDP for the next 14 years without the project will be in the range of 6.3% of GDP, but as a consequence of the program, the GDP growth rate will increase to 6.7% in the minimum scenario and 7% in the maximum scenario, i.e. its impact will create a temporary acceleration in GDP growth ranging from 0.4% to 0.7%.

TABLE IV-1
GDP growth (GY) without the project (SP) and with the project, under two scenarios



²⁰ G. Crespi and T. Rau.

²¹ The reason for this approach is to view the program as a temporary phenomenon, so that impacts attributable only to it may be measured. Additionally, it should be noted that these simulations assume an "immediate" impact. However, this result will make itself felt later on.

²² As the graph indicates, the "boosts" reach maturation immediately, and are temporary.

- 4.3 In estimating the internal rate of return (IRR) and the net present value (NPV), the model took into consideration the uncertain nature of the program's elements in assessing the accomplishment of those elements. The parameters taken into consideration were: (i) the maturation time for projects that the program will establish²³; and (ii) the size of the "boost" to TFP that the program may generate²⁴. As shown in Table IV-2, the program delivers a high IRR even in the less likely case of a 10-year maturation period. In that case, the IRR hovers in the 18% range. This is reflected in the NPV figures for that scenario, which are still in the positive range. Even in the most conservative scenario, with the longest maturation period, the social NPV (SNPV) of the program would amount to US\$179 million²⁵.

TABLE IV-2 INTERNAL RATE OF RETURN AND SOCIAL NPV EXPECTED FOR THE PROGRAM (expressed in millions of US\$)						
Year of Maturation	IRR Case 1	IRR Case 2	IRR Case 3	NPV Case 1	NPV Case 2	NPV Case 3
3	85%	86%	88%	2,009	2,205	2,404
4	62%	63%	65%	1,687	1,851	2,022
5	50%	50%	51%	1,380	1,516	1,658
6	41%	41%	42%	1,100	1,207	1,323
7	34%	34%	35%	835	922	1,013
8	28%	29%	29%	596	660	728
9	23%	23%	24%	378	419	467
10	18%	18%	19%	179	201	232

- 4.4 In summary, the economic analysis shows that the program's socioeconomic return is positive, even under conservative assumptions regarding critical program parameters.

B. Technical viability

- 4.5 The analysis of the program's technical viability reveals significant and active demand for innovation funds, as further reflected in ongoing excess demand during the past four years. This result holds regardless of the topical area or instrument analyzed. This excess demand has been regulated either through rationing (by rejecting projects) or by lowering subsidies for approved projects, which slants the selection process toward projects that are more profitable in the private sector,

²³ The maturation period assumed ranges from 2 to 10 years, although for the mix of projects involved in the program, it is expected that the most likely time frame will be approximately seven years.

²⁴ To assess this parameter, a triangular probability plot was used and three scenarios were defined based on the plot's mode position. The scenarios are: (i) the most conservative, in which the range of the boosts varies (0.0011-0.0018) with a mode of 0.0011; (ii) the intermediate scenario, in which the range of the boosts varies (0.0011-0.0018) with a mode of 0.0015; and (iii) the most optimistic, in which the boosts fall within the range (0.0011-0.0018) with a mode of 0.0018.

²⁵ Detailed statistics on these simulations are presented in the full report in the technical files.

which do not necessarily coincide with projects that offer greater social returns. For example, Table IV-3 compares the relationship between the number of projects having a positive social return and the number of projects ultimately approved in the FDI's innovation project competition in 1999. A total of 86 technology innovation projects were submitted in this competition for funds, of which 18 projects were financed. The average social present value of the approved projects amounted to \$6.205 billion. However, 35 additional projects with positive social present values were seeking funding, but they were unable to be financed owing to a lack of resources.

TABLE IV-3 RESULTS OF THE 5th NATIONAL PROJECT COMPETITION OF THE FDI			
Projects	No. of Projects	Average SNPV	Total SNPV
Approved	18	6,205	111,690 (69%)
Rejected with SNPV >0	35	1,430	50,050 (31%)
With negative SNPV	33		
TOTAL	86		161,740 (100%)

- 4.6 At FONTEC, the policy has been to adjust the subsidies granted to each project so that the greatest possible number of innovation projects may be financed. An approximate measure of the level of excess demand is to calculate what the demand for funds would have been if the amount of the subsidies granted were the same as the corresponding amount for the previous year. Since 1995, the number of projects approved per year has increased 60%. By contrast, the fund's resources have increased only 12%. The result is that the percentage of cofinancing demanded from enterprises has increased systematically, while the average contribution of the fund to each project has fallen 30%, from US\$62,000 to US\$43,000 per project. This leads to the selection of projects with lower relative risk, and ultimately to a lower degree of innovation.
- 4.7 Similarly, as shown in Table IV-3, the number of project submissions and approvals in the sectors supported by the program in the other funds operated within the program – FONDEF and FIA– show persistent levels of excess demand. This hardly means that every project should be financed; rather, it indicates that given such low approval rates, it is more likely that viable projects are going unfunded, as is the experience with FDI.

TABLE IV-4 FONDEF AND FIA FINANCING (No. of projects)						
	FONDEF			FIA		
	Submitted	Approved	% Approval	Submitted	Approved	% Approval
<i>Biotechnology</i>	10	1	10%	28	6	21%
<i>TIC</i>	5	1	20%	11	4	36%
<i>Quality</i>	6	1	17%	12	7	58%
<i>CP</i>	18	2	11%	4	1	25%
<i>Total</i>	39	5	13%	55	18	33%

- 4.8 The analysis of the technical viability also shows significant dynamism in terms of supply; in the past 10 years, Chile's National Innovation System has experienced one of the most dynamic periods for the establishment of institutions, laboratories, and research centers, particularly in the private sector and with a strong emphasis on the interaction of supply and demand in technology. This situation comes despite the fact that the system in Chile operates with greater efficiency than in the other countries in the regions. This indicates that the problem in Chile is not that the system is inefficient, but that its size is too limited.

C. Institutional and financial viability

- 4.9 The institutional structure proposed for program execution is based on mechanisms and procedures that were initially designed under the Bank-supported science and technology program, and were subsequently strengthened and expanded with resources from the Chilean government and through initiatives of the government itself during execution of the technology innovation program. Consequently, the present program stands to benefit from the cumulative experience from academic research, from manufacturing and industry, and from the public sector. thus making it possible to make institutional adjustments and changes to financial instruments that could ultimately increase the effectiveness of the national innovation system.
- 4.10 The experience gained in the recently completed program revealed that Chile has a broad range of technology services available to enterprises, in the public and private sectors. The supply of technology services for enterprises has the capacity to meet current demand. However, existing and new providers must continue the process of transforming and adapting to the needs of companies, to promote a broader and more efficient market. Specific needs that cannot be met within Chile will be addressed through procurement from foreign sources.
- 4.11 The analysis of counterpart feasibility sought to determine, in addition to the factors previously noted, the rationality of the categories to be financed and the projected amounts concerning the required contribution, estimated at approximately US\$25 million per year of the program. No problems are expected with regard to obtaining these allocations.

D. Social and environmental considerations

- 4.12 The program is designed to contribute in a sustainable manner to the increase in competitiveness. Specific criteria will be included in the program's Operating Regulations to ensure that, within the projects financed, steps are taken to provide for adequate management of natural resources and to mitigate negative environmental impacts. The Operating Regulations will specify that in order for any project in the forestry, agricultural, and aquaculture sectors in the technology development subprogram to be eligible for financing, it must comply with Chile's environmental protection and job safety laws for the project area. In addition, beneficiaries will be requested to present an assessment of the potential environmental impact that the technology to be developed could have on the environment and will be asked to propose a management plan of measures to mitigate the impacts. A team of specialists will be required to analyze these documents and decide on the eligibility of the prospective project. In the technology development projects, and particularly projects in support of the establishment of laboratories and research centers, the solution proposed for final treatment and disposal of project waste will be studied, as necessary, to ensure that the technology innovation incorporates the concept of environmental sustainability and that the costs are reflected in the project cost. Every effort will be made to identify potential negative impacts on the labor market resulting from technological changes that the program may bring about, and, if need be, mechanisms will be proposed to permit the introduction of appropriate mitigating steps within the labor market. Additionally, technological advances to improve the situation of disabled persons must be explored.
- 4.13 At its meeting (TRG 26-00) on 14 July 2000, the Committee on Environment and Social Impact approved Profile II, and recommended that consideration be given to introducing criteria in the program's Operating Regulations to foster the participation of indigenous groups and their organizations, mainly with respect to subprograms (1), (2), and (3), and to the participation of the National Indigenous Development Board (CONADI) in the program's consultative committees. The Operating Regulations contain clauses to ensure due consideration in the program for environmental management concerns, labor issues, and the indigenous groups aspect. Moreover, the program will draw on the support of a local consulting firm specializing in gender issues, which will be responsible for conducting activities to ensure that this area is included in the information systems of the Subsecretariat of Economy, and in the human resources training and education programs. The project's logical framework, approved by the Bank for startup of the program, will include indicators broken down by sex, as a means of gauging the program's impact on women and of identifying obstacles and providing appropriate corrective mechanisms. These mechanisms will be designed by the firm that provides consulting services on gender issues.

E. Benefits, sustainability, and risks

- 4.14 The proposed program will assist the country in the process of seeking, procuring, adapting, and developing new production and business management technologies, most of which are the responsibility of the State. Efforts will be made to correct certain flaws in the market that inhibit technology development and innovation. The program takes the training of human resources into account across the board in all its subprograms. Companies are expected to benefit from qualifying their workers rather than investing in human capital. Defects in the product markets will be minimized through indirect technical assistance subsidies directed toward the quality of products, services, management, and distribution.
- 4.15 Rather than financing primarily state R&D institutions and laboratories to develop and possibly transfer to society a series of new technologies to be used in the production of goods and services, the program will use its resources to finance businesses seeking technology, particularly small and medium-sized enterprises, which do not have a significant chance of paying for such spending on their own. The program will also use public bidding or open window systems to support the expansion of the supply of new technological information, using instruments subsidizing demand as well as public bidding.
- 4.16 Additionally, strategies to improve the environmental performance of manufacturing enterprises will be implemented, using ecoefficiency as a tool for sustainable development. The program will create national awareness of the significance of information technologies, publicize the benefits of those technologies, prepare the population to take advantage of what they have to offer, and promote the involvement in these new technologies of a variety of social entities, coordinating the various areas of the government that are responsible for this issue.
- 4.17 The additionality that the Bank brings to this program is rooted mainly in consolidating and expanding the technology fund system and in strengthening public and private institutions and mechanisms for technological development and innovation, particularly in areas that were not addressed during previous phases of the program, such as biotechnology, environmental management in the productive sector, information and communications technologies, and promoting quality as a key aspect of competitiveness. The Bank's resources will make it possible for technological progress in Chile to reach greater depth at a faster rate, serving as a catalyst for a "catch-up" process that will enable the Chilean economy to leap ahead in terms of competitive advantages. Additionally, the participation of the Bank in this program will provide new forums for developing an overall strategy for the S&T sector, and will create opportunities for sharing experiences and lessons learned with other countries in the region.
- 4.18 Evidence that the R&D activities supported by the program are sustainable is based on experience with the Science and Technology Program, which ended in 1995. It was found that the levels of R&D and private-sector participation in innovation

activities were far higher than the levels before the Bank's program. The proposed program provides for instruments and institutions that should improve and increase connections and mobility between the productive and academic sectors, on a long-term basis. In addition to this demonstration effect, the resulting increase in the supply of human and financial resources for technology innovation activities, given the strong demand and the high socioeconomic and financial return on the productive development activities in the supported sectors, should create a virtuous circle enabling the resources to be renewed.

- 4.19 Given the program's demand-based orientation, and the implicit uncertainty involved in research and technological innovation projects, there is a risk that not all the incentives will be applied to projects with the greatest chances for success. Nonetheless, experience in Chile has shown that projects selected for Technology Funds grow more quickly than the average, and that they generate increasing social returns.
- 4.20 As most of the program activities are intended to respond to demand from companies and institutions in the private sector, there is a risk that actual demand for some of the activities may be less than projected, producing imbalances in the advance of some components. This risk has been mitigated with the use of flexible mechanisms (such as performance contracts) so that resources can be transferred to those activities where demand is highest.

LOGICAL FRAMEWORK

TECHNOLOGY DEVELOPMENT AND INNOVATION PROGRAM (SUMMARY)

Objectives	Verifiable Indicators	Means of Verification	Assumptions
GOAL			
Strengthening national competitiveness through technological and innovation development in strategic areas of the economy, and transferring and disseminating them within the entrepreneurial sector, particularly among small and medium-sized enterprises.	Competitive strengthening of Chile in the global economy. Notable presence of Chile's national innovation system in the region, in selected strategic areas.	GDP growth. Growth in total factor productivity (TFP). Indicators of the Ibero-American Network of Science and Technology Indicators (RICYT). Foreign trade and S&T spending statistics. Business surveys and ad hoc studies.	The country implemented development strategies that combine productive and export diversification with systematic value added in the production of goods based on natural resources. It is possible to incorporate the national science and technology effort into the development effort into the productive sector.
PURPOSE			
Strengthening national competitiveness for technological innovation development in Chile by implementing strategic programs in priority areas, transferring and disseminating them within the entrepreneurial sector, particularly among small and medium-sized enterprises.	Increase national investment in science and technology, particularly in the productive sector. Increase the number of enterprises that conduct technology innovation activities on a daily basis. Increase innovative efforts in the sectors most directly benefiting from the implementation of strategic programs. Increase the number of professionals and technical experts involved in technology innovation and development activities.	Growth in total factor productivity (TFP). Indicators of the Ibero-American Network of Science and Technology Indicators (RICYT). Foreign trade statistics (Central Bank) and S&T spending statistics (CONICYT). Business surveys and ad hoc studies.	
SUBPROGRAMS:			
SUBPROGRAM 1: Prospective Study of Technological and Productive Development in Chile			
GOAL			
Strengthening national competitiveness for innovation and development in Chile by implementing strategic programs in priority areas, transferring and disseminating them within the entrepreneurial sector, particularly among small and medium-sized enterprises.			

Objectives	Verifiable Indicators	Means of Verification	Assumptions
PURPOSE			
<p>Prioritize a set of areas in Chile's strategic programs are element that will serve as the main technological and productive Chile.</p>	<p>Identification of a set of economic and technological areas, clearly specified and prioritized in accordance with predetermined criteria.</p> <p>Form consensus concerning these priorities among the parties involved in the national innovation system.</p>	<p>Work groups with the broad participation of parties involved in the national innovation system.</p> <p>Surveys and other consultation documents. Midterm and final reports.</p>	<p>Existence of a national agreement on the long-term vision on national technology development.</p> <p>Disposition of the parties involved in the national innovation system to cooperate, build consensus, and legitimacy to the priorities defined, through processes.</p> <p>Chile has the scientific and technological, and public administration capacities needed for a forward-looking vision of the country's technological productive development.</p>
SUBPROGRAM 2: Information and Communications Technologies			
GOAL			
<p>Stimulus for innovation and development in Chile by strategic programs in priority areas, disseminating them within the sector, particularly among small and medium enterprises.</p>			
PURPOSE			
<p>Development and use of the new communications technologies, and the Internet among Chilean enterprises.</p>	<p>Increase the number of enterprises that use these technologies daily to 300,000 by the end of the program.</p> <p>Increase the competitiveness of enterprises in the ICT sector.</p> <p>Development of a network information system for SIRE company.</p>	<p>Supplemental survey to the Annual National Industrial Survey (ENIA), concerning Internet connectivity and use.</p> <p>Information on the Internet client base of telecommunications enterprises, compiled by Subtel.</p> <p>Surveys and information systems devised for this purpose.</p>	<p>The e-commerce bill is passed and enters into force.</p> <p>The government remains interested in interconnecting departments to the network before the end of the program.</p> <p>Web technology and the Internet continue to be dominant technologies.</p>
SUBPROGRAM 3: Technological Development in the Forestry, Agriculture, and Aquaculture Sectors			
GOAL			
<p>Stimulus for innovation and development in Chile by strategic programs in priority areas, disseminating them within the sector, particularly among small and medium enterprises.</p>			

Objectives	Verifiable Indicators	Means of Verification	Assumptions
PURPOSE			
Technological development and innovation in forestry, agriculture, and aquaculture sectors, improving their competitiveness, by quality of products and processes, and developing capacities in this area in the country.	<p>Training in underserved areas. Financing of biotechnology projects.</p> <p>Compiling, analyzing and disseminating national policies and technological advances in this area.</p> <p>Strengthening public support capacities for technological development and innovation in the forestry, agriculture, and aquaculture sectors.</p>	<p>Database of State development funds and institutions (CONICYT, FIA, CORFO).</p> <p>Program execution report.</p> <p>Ad hoc studies and audits.</p>	<p>The government views biotechnology development in forestry, agriculture, and aquaculture sectors as a priority.</p> <p>There is a need and demand for productive services based on the use of biotechnology.</p> <p>Increasing development of the biotechnology services market.</p>
SUBPROGRAM 4 : Environmental Management in the Productive Sector			
GOAL			
Stimulus for innovation and development in Chile by strategic programs in priority areas, disseminating them within the productive sector, particularly among small and medium enterprises.			
PURPOSE			
Increase in competitiveness and environmental performance of enterprises, particularly SMEs, by supporting the cleaner production processes while focusing on the prevention rather than the remediation of environmental problems.	<p>Creation and implementation of instruments involving formal commitments such as framework agreements etc.</p> <p>Increase in the number of cleaner production agreements reached and successfully operating.</p> <p>Increase in the number of players committed to cleaner production within the institutions involved.</p> <p>Increase in the planning, coordination, monitoring, and evaluation capacities for the activities established, in support of Cleaner Production.</p> <p>Increase in the number of environmental projects that receive CORFO cofinancing.</p>	<p>Indicators from monitoring and control of cleaner production agreements.</p> <p>Surveys and other consultation documents in public institutions, professional and industrial associations, and enterprises.</p> <p>Case studies.</p> <p>CORFO database.</p> <p>Ad hoc studies.</p>	<p>The government maintains its interest in promoting cleaner production among enterprises.</p> <p>Local financial institutions incorporate financing of environmental projects in their services.</p> <p>The Public-Private Cleaner Production Committee meets regularly and meets its long-term commitments.</p> <p>The Network of Cleaner Production Centers operates effectively.</p> <p>Cleaner production agreements continue to be valued by the parties called upon and involved.</p>

Objectives	Verifiable Indicators	Means of Verification	Assumptions
	Creation of a system of accreditation and/or certification for cleaner technologies.		
SUBPROGRAM 5: Promoting Quality for Competitiveness			
GOAL			
etus for innovation and development in Chile by strategic programs in priority areas, disseminating them within the sector, particularly among small d enterprises.			
PURPOSE			
productivity and quality of particularly SMEs, as a result of the management models and Chile's quality infrastructure.	<p>Adoption by enterprises, particularly SMEs, of a self-cvaluation and excellence management model.</p> <p>Implementation of quality management standards within enterprises and the support necessary for certifying businesses on that basis.</p> <p>Expanding quality infrastructure with regard to technical standards, metrology, and accreditation.</p>	<p>Annual records and reports of CNPC, CORFO, and INN.</p> <p>Records of enterprises certified according to quality management standards in Chile.</p> <p>Project execution reports.</p>	<p>Enterprises become more aware of the adv using efficient management models.</p> <p>Quality and quality management continue importance in the national and international</p> <p>Awareness is generated with regard to cert on quality management standards in Chile</p>

TECHNOLOGY DEVELOPMENT AND INNOVATION PROGRAM TENTATIVE PROCUREMENT TABLE

Principal program procurements (expressed in thousands of US\$)		Financing	Method	Prequalification	Dates Half
1. Goods (as part of projects) <u>Total estimated value US\$17,117.6</u> Technical equipment of various sorts will be acquired: measurement and processing instruments, lab equipment, computers, etc. Small-scale construction will be performed. Given the individual and innovative characteristics of the projects, it is impossible to provide typical examples of lots or calls for bids. The figures will be adjusted annually.					
Hardware	Year 1, multiple calls for bids, US\$659.7	IDB 50%	LB	No	I/01, II/01
	Year 2, multiple calls for bids, US\$831.0	"	LB	No	I/02, II/02
	Year 3, multiple calls for bids, US\$930.0	"	LB	No	I/03, II/03
	Year 4, multiple calls for bids, US\$678.0	"	LB	No	I/04, II/04
Construction	Year 1, multiple calls for bids, US\$435.0	"	LB	No	I/01, II/01
	Year 2, multiple calls for bids, US\$534.3	"	LB	No	I/02, II/02
	Year 3, multiple calls for bids, US\$592.3	"	LB	No	I/03, II/03
	Year 4, multiple calls for bids, US\$470.0	"	LB	No	I/04, II/04
Inputs	Year 1, multiple calls for bids, US\$2,306.0	"	LB	No	I/01, II/01
	Year 2, multiple calls for bids, US\$4,293.3	"	LB	No	I/02, II/02
	Year 3, multiple calls for bids, US\$2,813.5	"	LB	No	I/03, II/03
	Year 4, multiple calls for bids, US\$2,288.5	"	LB	No	I/04, II/04
Library	Year 1, multiple calls for bids, US\$72.0	"	LB	No	I/01, II/01
	Year 2, multiple calls for bids, US\$96.0	"	LB	No	I/02, II/02
	Year 3, multiple calls for bids, US\$60.0	"	LB	No	I/03, II/03
	Year 4, multiple calls for bids, US\$58.0	"	LB	No	I/04, II/04
2. Services (as part of projects) <u>Total estimated value: US\$133,607.4</u> The projects will contract with individual and institutional experts, consultants, researchers. Given the unique characteristics of each project, the figures given are the total for all projects expected for each year of execution. No contracts are expected to exceed US\$200,000. The figures will be adjusted annually.					
Year 1, multiple calls for bids, US\$23,494.8		IDB 50%	LB	No	Bidding through the year during the period of execution
Year 2, multiple calls for bids, US\$38,924.6		"		No	
Year 3, multiple calls for bids, US\$38,576.5		"		No	
Year 4, multiple calls for bids, US\$32,611.5		"		No	
3. Human resources training services <u>Total estimated value: US\$14,107.3</u> Specialized instruction and training will be financed as part of the projects, including scholarships, which, owing to their unique nature, cannot be defined ahead of time; however, specific public bidding will be conducted.					
Year 1, multiple calls for bids, US\$2,477.0		IDB 50%	LB	No	Multiple calls for bids during the period of execution.
Year 2, multiple calls for bids, US\$4,493.0		"	LB	No	
Year 3, multiple calls for bids, US\$3,452.0		"	LB	No	
Year 4, multiple calls for bids, US\$3,685.3		"	LB	No	
4. Total estimated value (US\$164,832.3)		"			

LB-Local Bidding

PROPOSED RESOLUTION

**CHILE. LOAN /OC-CH TO THE REPUBLICA DE CHILE
Technology Development and Innovation Program**

The Board of Executive Directors

RESOLVES:

That the President of the Bank, or such representative as he shall designate, is authorized, in the name and on behalf of the Bank, to enter into such contract or contracts as may be necessary with the República de Chile, as Borrower, for the purpose of granting it a financing to cooperate in the execution of a Technology Development and Innovation Program. Such financing will be for the amount of up to one hundred million dollars of the United States of America (US\$100.000.000), which are part of the Single Currency Facility of the Ordinary Capital resources of the Bank, and will be subject to the "Special Contractual Conditions" and the "Financial Terms and Conditions" of the Executive Summary of the Loan Proposal.